

ROADS AND STREETS

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Varied Views of Low Cost Road Machine

LOW COST

Plant-Mixed Bituminous Road

Oversize Rock Crushed on Road Ahead of Mixing Plant

By S. E. FITCH

County Superintendent of Highways,
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A NEW method of building roads has been developed by the County Highway Department of Chautauqua County, New York, using local materials, which, it is believed, may, with some modifications, be used in other localities not only to reduce the costs but also to improve the quality of the roads built over that of other methods employed in the past. The essential features consist in building a thick, substantial foundation by using large quantities of cheap local gravel of only fair quality, all handled mechanically by modern road machinery; sorting out the large sized stone on the road, crushing it with a traveling crusher and mixing the run-of-crusher material (without

screening) with a definite quantity of fairly stiff bitumen (hot or cold) by means of a traveling mixer; immediately spreading and rolling the mixed material and opening the road to traffic. In more detail the process is as follows:

The roads are well graded and drainage structures are provided the same as for a first class macadam or concrete road. A 12 in. trench one foot wider than the contemplated pavement is then made by blade graders scraping the center out onto the shoulders. "Weep holes" are dug through these shoulders at intervals of about 100 ft., this distance varying with the character of the soil and the topography.

A power shovel is placed in a gravel creek bed or other gravel bank. This shovel loads run-of-bank gravel into 3 ton to 5 ton trucks equipped with dual pneumatic balloon tires. This run-of-bank gravel is hauled onto

the road and spread in a layer of about 9 in. loose thickness. For this work we use home made gravel spreaders or steel commercial spreaders. Fig. 1 shows such a spreader being used with fine gravel. We begin dumping at the point nearest the pit and haul over the deposited gravel to aid in compacting it. The coarsest stones are thrown onto the shoulder by hand directly



Fig. 1—Homemade Gravel Spreader at Work

after dumping. Fig. 2 shows this stage of the work. The weep holes are filled with suitable porous gravel either prior to or at the same time as the spreading of the gravel.

After this first layer has been spread, a leveling and smoothing machine called the "York Rake" is run over the gravel. This machine (see Fig. 3) has in the center ordinary maintainer blades for smoothing up the road and it also has two rows of narrow spring teeth something similar to those of a spring tooth harrow, in the



Fig. 2—Coarse Stone Is Piled Along Shoulder

rear. These teeth are set close together laterally and about 2 in. apart longitudinally, making a diagonal row so that as the machine progresses the fine material will sift between the teeth while stones over 2 in. in diameter will be held in front of the row of teeth and tumbled over and transferred laterally into a windrow on the right hand side of the road.

After this sorting out of all stone over 2 in. in diameter this layer is rolled and compacted to a thickness of about 6 in., after which another layer is put on and treated in exactly the same manner. If possible we allow this gravel foundation to remain as a gravel road over winter with the coarse stone on the shoulder. This

not only assures complete consolidation but also gives opportunity the next spring to strengthen with another layer any weak spots that may be developed by the heavy hauling over it during construction or during the winter.

When this gravel is thoroughly compacted we again smooth it up with a long wheel base road maintainer (see Fig. 4), after which we roll it down hard. Then we give it an application of 0.3 gal. per sq. yd. of cold tar with no cover. When this has soaked in and dried we pull the coarse stone back onto this surface by hand or by the use of potato hooks (See Fig. 5). We follow up this operation with a self-propelled traveling crusher



Fig. 3—The "York Rake" Helps Smooth Up the Grade

and feed all the stone over 2 in. size into this crusher by hand and by stone forks. This crusher (See Fig. 6) was designed and assembled in our own shops but similar machines are now on the market. This run-of-crusher stone is dropped onto the road in a windrow without screening (See Fig. 7). The screen analysis



Fig. 4—Long Base Maintainer Follows Compaction

varies somewhat with the kind of stone, the jaw opening and the condition of the crusher jaw plates but may be taken on the average about as follows:

100 per cent passing 2 in. screen; 67 per cent passing 1 in. screen; 54 per cent passing $\frac{3}{4}$ in. screen;

148

41 per cent passing 3 in. screen; 23 per cent passing 1 1/4 in. screen; 14 per cent passing No. 10 screen; 10 per cent passing No. 20 screen; 7 per cent passing No. 50 screen; 4.6 per cent passing No. 100 screen; 2.8 per cent passing No. 200 screen.

In some instances when the gravel bank contains large amounts of coarse material, there is enough stone



Fig. 5—After Smoothing Subgrade Coarse Stone Thrown Back on Road

to make a compacted pavement 2 in. or more in thickness. In other cases, where the quantity of coarse stone is not sufficient for this, we haul in and add either stone, pea gravel, or slag, to the windrow, depending on which is cheapest or most suitable for that particular location. In this way we bring the quantity of loose material up to 12 or 15 yd. per station. In supplementing this stone with commercial stone or slag some attention can be given to grading the different sizes to produce a dense mix.

Immediately behind the crusher we run a recently



Fig. 6—Portable Crusher Follows Next

designed cold mix bituminous road mixer over the road and mix the stone with tar or asphalt in the proper percentage to produce a dense close mix. This machine (See Fig. 8) is also self-propelled with several very slow speeds so that it feeds itself into the windrow, elevates it by a bucket elevator, dumps it into a revolving hopper where it is automatically weighed and tripped. The tripping action also discharges the predetermined amount of hot or cold bitumen into the single barrel pug mill along with the stone. This mixed material is dropped back onto the road again. If a light bituminous material such as used in retread work is used, the mix is dropped into a windrow and can be

spread onto the road with a one-man grader. If a heavy hot bitumen is used it is better to let the mix drop onto a sheet steel shoveling plate chained to the machine and dragged along with it. This facilitates the spreading of the mix by hand with asphalt forks and rakes (See Fig. 9). When spread the pavement is immediately rolled down, at first with an 8 ton tandem roller followed up by a three wheel 10 to 12 ton roller. The road is then ready for traffic. On most roads local traffic is permitted at all times, as the machine can be passed without great difficulty. In some cases we found it advantageous to keep the mix rather lean and after rolling and drying out to give the pavement a surface treatment of about 1/4 gal. per sq. yd. with a very light cover of coarse sand. This would



Fig. 7—Windrow of Unscreened Run-of-Crusher Rock

seal it up and give a water proof surface. In other cases where a richer mix was used, no seal was necessary. The resulting pavement is seen in Fig. 10.

The advantages of this method over others are:

(1st) The foundation course is thick and with a good gravel is quite stable and very cheap.

(2nd) By using a run-of-crusher top stone made from the oversize gravel of the foundation course we not only obtain the cheapest stone possible to get in the locality but we also save the screening operation and obtain a material the screen analysis of which closely approximates that of a very good hot mix job. The stone dust and fine material under 1/4 in. being advantageous rather than detrimental.

(3rd) With such a mixing machine it is possible not only to get a more uniform mix than by the mixed-in-place method but it is also possible to use a stiffer bitumen as it can be heated to any desired temperature either in the tank cars, in the hauling distributor or in the tanks of the mixing machine itself.

We found that a better mix was obtained when the crushed stone was dry and to assure this on our last job we ran the crusher and mixer in tandem. The capacity of the 10 in. by 20 in. secondary crusher was about half that of the mixer, consequently we ran the crusher in two 8-hour shifts in order to keep ahead. We also had strips of waterproof paper or tarpaulin to cover any short windrow of crushed stone between the crusher and mixer in case of rain. When this running in tandem was not done it would be necessary after rains to spread out the wet windrow to dry before

mixing. A larger capacity crusher would also be advantageous. We were not seriously delayed by rain, however, even when crushing was done some time in advance, as our record of progress shows.

This mixing machine was started July 9th and on October 3rd had completed 16.7 miles of 16 ft. pavement. Considerable time was lost experimenting with various kinds of bitumen to see which produced the best results. Some time was lost waiting for the crusher to get ahead and some delay was caused by rain, etc. The machine was in operation on 51 days, making an



Fig. 8—Cedar Rapids Bituminous Road Mixer Used to Lay Surfacing

average of $1/3$ mile per day worked. The longest run was 2,450 lin. ft. of 16 ft. pavement.

Good results were produced both with tars and asphalts. With run-of-crusher aggregate best results were obtained with the following consistency of the bitumen: for tars, from a heavy hot application to a light binder or with a viscosity of about 50 at 50° C. and for asphalts an oil of about 75 per cent asphaltic content. These were used at a temperature of about 200° F. for tar and 300° F. for asphalts. In general the asphalt appeared to furnish a tougher pavement while the tars were somewhat more penetrating and gave a more uniform mix when the aggregate was dusty. When using stiff bitumen too heavy to spread by blade



Fig. 9—Spreading the Mix After It Leaves the Machine

graders we used on the machine 2 operators, 2 men on the front end, 2 to make shoulders, 1 foreman, 10 shovelers and 3 rakers on the rear. With bituminous material such as used in retread a one-man power grader would replace these 13 rear men.

Costs do not mean much unless we know all the conditions accompanying the work. In general, under average conditions, with a one mile haul, the gravel foundation 17 ft. wide and 12 in. to 18 in. thick, using 4500 cu. yd. (measured loose) per mile, with a seal coat of $1/3$ gal. will cost in place about \$4,000. A top course of mixed run-of-crusher material, made from the oversize gravel, 2 in. thick consolidated, will require about 9,000 gal. of bituminous material per mile and the total cost will be about \$3,000 per mile for 16 ft. in width; of this, crushing the oversize gravel costs about 70 ct. per cu. yd. of loose material. This gives a very cheap



Fig. 10—Finished Pavement Gives Excellent Riding Surface

coarse aggregate. The labor with the mixing machine when spreading by hand costs \$300 to \$350 per mile. If spread with a grader this can be reduced to about \$200 per mile.

These costs do not differ greatly from mixed-in-place work but a more uniform mix is obtained and a stiffer bitumen can be used than would be possible by the blade mix. Experiments conducted on a small scale indicate that for some gravel banks it will be possible to use the run-of-bank gravel as it comes from the pit, merely taking out those particles over $2\frac{1}{2}$ in. in diameter. In such cases the machine can be used either in the pit or on the road. The future for this kind of work seems promising.

Digging Curb and Gutter Trench



This machine dug all the curb and gutter trenching in rock on approximately 5 miles of paving in the town of Lyons, Illinois. The contractor, Albin Carlson and Company of Chicago, claim this method of trenching is a cost cutting process. At times an air compressor and rock drill augmented the ditcher

State and County Highway Construction in 1931 and 1932

Reports from Highway Officials Showing Probable Expenditures

New England States

Massachusetts

The accompanying tabulation shows the highways completed and accepted during the fiscal year 1931, including state highways and highways on which the construction is supervised by state highway department.

Types	Miles	Average Width Sur- faced Ft.	Thickness Inch	Estimated Average Cost Per Mile
P. C. Concrete.....	41	30 to 40	8	-----
Bituminous Concrete	34	24 to 30	4½	-----
Bituminous Macadam	101	24 to 40	7	-----
Gravel	24	20	6	-----
Dual	12	-----	-----	-----

The contracts let but not completed during fiscal year 1931, including state highways and highways on which the construction is supervised by the department were as follows:

Types	Miles	Probable Expenditure
P. C. Concrete.....	47	\$4,236,872
Bit. Concrete	3	58,494
Bit. Mac.	68	4,524,746
Dual	16	1,078,753
Gravel	7	188,086

The program for 1932 has not been definitely decided as yet. However probably the same amount of work will be done during next year as in 1931. A. W. Dean, Boston, Mass., is chief engineer, state department of public work.

New Hampshire

The following table gives some details of the 1931 work:

New Hampshire State Highway Completed in 1931

Types	Miles	Average Width Sur- faced, Ft.	Thickness, In.	Estimated Average Cost per Mile
P. C. Concrete.....	35	20	6-6-9	\$37,365
Bituminous Macadam	7	20	3	27,410
Gravel Surface Treated.....	116	21 & 24	7 av.	9,100*
Crushed Gravel S. T.....	4	24	7	20,440

*Estimated.

The proposed new construction for 1932 include:

Types	Miles	Probable Expenditure
P. C. Concrete.....	20	\$1,000,000
Bituminous Macadam	5	100,000
Gravel Surface Treated.....	92	1,000,000
Plain Macadam	8	275,000

F. E. Everett, Concord, N. H., is state highway commissioner.

Vermont

One of the features of the state highway work in 1931 was the construction of a considerable mileage of bituminous mix surface. In all 95.5 miles of this were completed. Other types completed included 31 miles of concrete, and 12½ miles of bituminous macadam. Some details of the 1931 work follows:

Vermont State Highway Completed in 1931

Types	Miles	Average Width Sur- faced, Ft.	Thickness In.	Estimated Aver. Cost Per Mile
P. C. Concrete	30.8	18	7	\$33,601
Bituminous Macadam	12.5	18	3	33,404
Gravel	8.3	24	6	11,299
Graded and Drained.....	16.8	24	-----	10,357
Bituminous Mix.....	95.5	18	-----	9,321

The uncompleted state highway carried over to 1932 included 7.3 miles of bituminous mix including a probable expenditure of \$70,449.

The program for 1932 is not yet available.

H. E. Sargent, Montpelier, Vt., is state highway commissioner.

Connecticut

State highway completed in 1931 comprised the following:

Connecticut State Highway Completed in 1931

Types	Miles	Average Width Sur- faced, Ft.	Thickness In.
P. C. Concrete.....	31.0	20	8
Brick	-----	-----	-----
Bituminous Concrete .....	.73	20	3
Bituminous Macadam.....	18.0	20	3
Gravel	11.5	20	8
Plain Macadam.....	91.0	20	7
Graded and Drained.....	.5	-----	-----

The uncompleted work carried over to 1932 included 58 miles of concrete, 1½ miles of bituminous macadam, 25 miles of water bound macadam and 12½ miles of graded and drained road.

Details of the 1932 program are not available at this time.

John A. MacDonald, Hartford, Conn., is state highway commissioner.

Rhode Island

A total of 54 miles of state highway was completed in 1931. This included 20 miles of concrete, 31 miles of bituminous macadam and 2 miles of 40 ft. wide sheet asphalt on concrete base. The cost of this work is shown in the table below.

Rhode Island State Highways Completed in 1931

Types	Miles	Average Width Sur- faced, Ft.	Thickness, In.	Estimated Average Cost per Mile
P. C. Concrete.....	20	20-40	8	\$35,000-\$60,000
Bituminous Macadam	31	20	8	\$28,000
Gravel	1	20	6	10,000
Sheet Asphalt on Conc. Base	2	40	*	40,000

*3 in. top on 6 in. base.

The new construction proposed for 1932 includes 15 miles of portland cement concrete, 11 miles of bituminous macadam, 6 miles of graded and drained road and 8 miles of sheet asphalt on concrete base. The probable expenditure is \$2,000,000.

George H. Henderson, Providence, R. I., is chief engineer, State Board of Public Roads.

Middle Atlantic States

New Jersey

During 1931 there was completed on the state highway system approximately 2,751 miles of 20-ft. width bituminous concrete pavement; 0.433 miles of bituminous macadam pavement 20 ft. wide; and 9.550 miles of highway were graded and drainage facilities constructed, being graded 40 ft. There was also completed 120.764 miles of reinforced concrete pavement 20 ft. wide and in some cases of variable widths up to 350 ft., this width being on a portion of the plaza approach to the George Washington Bridge at Fort Lee. 66.608 miles of reinforced concrete pavement construction under way during 1931 will carry over into 1932.

A rather rough analysis of some of our standard modern highway construction projects with 9 in. rein-

forced concrete pavement 20 ft. wide with 10-ft. earth shoulders, graded 40 ft. and in some cases 50 ft. wide, contracted for in 1931 throughout the several territories of the State of New Jersey, exclusive, however, of work in the metropolitan area and construction of so-called super-highways, which, of course, are not representative nor comparable to general highway construction work, indicates that the following figures would represent a fair average cost per mile of New Jersey highway construction during 1931.

Average cost per mile for road work.....	\$52,250
Average cost per mile for bridge work.....	10,000
Average cost per mile for right of way.....	15,000

Total average cost per mile.....\$77,250

An interesting comparison of costs is shown by a similar analysis made for the work contracted for in 1929, which indicated the following costs for similar work although the pavement thickness constructed at that time was mostly 8 in.

Average cost per mile for road work.....	\$76,279
Average cost per mile for bridge work.....	6,528
Average cost per mile for right of way.....	15,400

Total average cost per mile.....\$98,207

The increase in bridge cost for 1931 is due to construction of much greater width of bridges, although the unit prices for this type of work have greatly decreased.

Although the 1932 construction program has not as yet been definitely and officially adopted, it may be expected that the following work will be undertaken by the department during 1932:

R. C. Pavement, 91.83 miles.....	\$15,250,000
Graded and Drained, 15.5 miles.....	1,500,000
Viaduct Construction, 6.45 miles.....	7,725,000

For the past two years the department has had under construction a high level viaduct including high level bridge over the Hackensack and Passaic Rivers between Jersey City and Newark, which work may be completed along about this time next year, although it is not scheduled for completion until sometime early in 1933.

J. L. Bauer, Trenton, N. J., is state highway engineer.

New York

During 1931 a total of 1,005 miles of state highway was placed under contract at a bid price of approximately \$47,000,000. The program for 1932 has not yet been decided.

E. C. Lawton, Albany, N. Y., is Construction Deputy of Highways.

East North Central States

Ohio

State highway work completed in 1931 included 297 miles of 20 ft. wide 8 in. thick concrete pavement, 92 miles of 40 ft. wide brick pavement, 9 miles of bituminous concrete, 28 miles of bituminous macadam, 28 miles of macadam, 22 miles of graded and drained roads, 15 miles of concrete widening 2 ft. to 4 ft. on both sides, 13 miles of macadam widening, 29 miles of gravel road and 4 miles of 30 ft. wide sheet asphalt.

The 1932 program covers 845 miles and the estimated cost is \$24,000,000. The funds with which this program is to be financed comes from the state's regular construction fund derived from the 4 ct. gas tax, state's maintenance and repair fund also from gas tax and license fees to be spent on reconstruction projects,

regular Federal Aid appropriations, and a comparatively small amount of local cooperation money from subdivisions such as the county, city and in some instances railroad where a grade crossing elimination is involved. The program includes the following:

Types	Miles	Probable Expenditure
P. C. Concrete	260	\$6,250,000
Brick	110	4,500,000
Plain Macadam.....	30	900,000
Graded and Drained	20	250,000
Bituminous Cone Resurfacing and Widening.....	300	4,500,000

O. W. Merrell, Columbus, O., is director state highway department.

Illinois

During 1931 the state completed 762 miles of paving, 112 miles of grading and 123 bridges. Up to Dec. 1 the expenditures for construction on the state system was \$28,558,000.

The construction program for 1932 will involve approximately 1,000 miles of paving on the state system, a considerable amount of widening, grade separations, large bridge and reconstructing resurfacing of city streets. Estimated cost is \$40,000,000. Counties using their share of gasoline tax funds supplemented by other funds will have approximately \$16,000,000 to expend and will build about 700 miles of highway.

Frank T. Sheets, Springfield, Ill., is chief Highway engineer.

Indiana

During 1931 the state highway commission constructed 350.873 miles of concrete pavement. The average width of surface was 20 ft., and it was of 9 in.-7 in.-9 in. design. In addition, the department constructed 28.002 miles of heavy grading. The average cost of pavement per mile was \$23,654.14, and of grading \$18,183.74. 46.7 miles of concrete pavement were carried over to 1932, 10.253 miles of grading were also uncompleted at the close of 1931.

The department plans to pave and grade between 400 and 450 miles of road during the 1932 construction season. It is estimated that approximately \$13,870,000 will be spent for construction, exclusive of right-of-way costs and the cost of constructing bridges.

William J. Titus, Indianapolis, Ind., is chief engineer state highway commission.

Michigan

State highway surface mileage placed in 1931 up to Dec. 1 was as follows:

Types	Total Miles
Concrete	327.36
Concrete Widening.....	36.45
1-Course Gravel.....	38.95
2-Course Gravel.....	75.09
Asphalt on Concrete.....	.70
Asphalt on Gravel.....	43.20
Bituminous Retread.....	26.17
Gravel Resurfacing.....	73.94
Bituminous Surface Treatment	7.55
Total	629.45

In order to provide winter employment for approximately 30,000 workers, the state highway department is rapidly placing under construction a \$10,000,000 winter road construction program consisting mostly of grading, drainage structures, grade separations and bridges, also betterments. A large number of the projects now being put under construction include surfacing to be placed during 1932. In order to insure that the work as specified shall be carried on this winter, the department has estimated the amount of each contract that can be carried on during the winter, and are requiring that the contractor shall have the percentage as estimated, completed on or before April 1, 1932.

The department is including in the special provisions set up in the proposals, that a definite type and amount of equipment be used, stipulating some work for hand labor, the use of team powered wheelers or equivalent equipment, and permitting the use of a definite number of power shovels, with a limited capacity for trucks used in moving the earth away from the power shovels.

In order to provide a maximum number of men with work the department requires that to the fullest extent possible, all employees on state highway projects shall work part time, either three days a week or alternate weeks. In connection with employment, it is specified that the contractor shall employ not less than 75 per cent of all labor used on the work, from lists of unemployed furnished by the state employment commission through its local committees, and that a minimum wage of 35 ct. per hour be paid. In this way the contractor is permitted 25 per cent of the forces to consist of his foreman, machine operators and other key men essential to the efficiency of his organization.

Projects are being placed, as far as possible, according to the urgency of the need for unemployment relief. While all sections of the state are being granted a portion of the work, the need for relief is most acute in the southern part of the Lower Peninsula, and this need will receive first consideration as it is the object back of the entire program.

It is not possible that this time to give a definite program for the construction work for 1932.

Grover C. Dillman, Lansing, Mich., is state highway commissioner.

Wisconsin

Highway construction of all types in 1931 including county work totaled 1,646 miles and cost \$17,848,000. The proposed state highway construction for 1932 calls for 457 miles of all type of roads. The estimated cost is \$10,830,000. This is exclusive of the work that will be financed by the counties, information on which is not yet available.

W. C. Buetow, Madison, Wis., is state highway engineer.

West North Central States

Minnesota

Expenditures in 1931 for state highway construction amounted to \$29,181,500. Estimated expenditure for 1932 is \$30,000,000. J. T. Ellison, St. Paul, Minn., is chief engineer, State Highway Department.

Iowa

Primary road construction program for 1932 will probably include 200 miles of pavement, 350 miles of grading and bridging and 675 miles of graveled surfacing. Total construction expenditure will approximate \$11,000,000.

Fred R. White, Ames, Ia., is chief engineer state highway commission.

North Dakota

State highway completed in 1931 included 570 miles of graded and drained road, 122 miles of regraded road and 210 miles of regaveled road. Details of the work follow:

North Dakota State Highways Completed in 1931

Types	Miles	Average Width Surfaced, Ft.	Thickness, In.	Estimated Average Cost per Mile
P. C. Concrete.....	11.5	20	9-7-9	\$25,000
Bituminous Macadam		22	3	5,000
Gravel		18	..	1,100
Graded and Drained.....	570	24	..	3,200
Re-Graded	122	24 & 36	..	3,000
Re-Graveled	210	18	..	600

The uncompleted work carried over to 1932 included 260 miles of graded and drained road, 350 miles of gravel road and 48 miles of bituminous macadam. The probable expenditure is \$1,000,000.

Details of the 1932 program will not be approved until the latter part of January. However, the probable expenditure will be \$2,800,000.

H. C. Frahm, Bismarck, N. Dak., is state highway engineer.

South Dakota

The table below gives some details of the state highway work completed in 1931.

South Dakota State Highway Completed in 1931

Types	Miles	Average Width Surfaced, Ft.	Thickness, In.	Estimated Average Cost per Mile
P. C. Concrete.....	80	20	9-6-9	\$23,860
Bituminous Concrete	5	20	2½	8,000
Gravel	435	24	6	1,625
Graded and Drained.....	300	32	..	3,775
Oil Mix Gravel.....	140	20	3	3,500
Tar Treated Gravel.....	45	20	3	4,000

The uncompleted state highway work carried over to 1932 included 84 miles of graded and drained road involving a probable expenditure of \$300,000; 54 miles of gravel surfacing, probable expenditure \$85,000; and 50 miles bituminous surfacing, probable expenditure \$200,000.

The proposed new construction for 1932 includes the following:

Types	Miles	Probable Expenditure
P. C. Concrete.....	40	\$1,000,000
Gravel	200	300,000
Graded and Drained.....	300	1,200,000
Oil Mix Gravel.....	300	1,000,000

J. H. Lake, Pierre, S. Dak., is chief engineer, state highway commission.

Missouri

Definite figures on the state highway completed in 1931 are not yet available. Approximate mileages are estimated to be as follows:

Missouri State Highways Completed in 1931

Types	Miles	Average Width Surfaced, Ft.	Thickness, In.
P. C. Concrete.....	280	20	6*
P. C. Concrete.....	135	10	6*
Gravel	1,200	18	4
Graded and Drained.....	1,527	..	..
Miscellaneous	13	..	..

*At center.

The program for new construction for 1932 has not definitely been decided upon. However, an estimate is as follows:

Proposed New Construction for 1932

Types	Miles	Probable Expenditures
P. C. Concrete.....	378.0	\$12,470,000
Bituminous Macadam	3.7	40,800
Gravel	2,034.3	17,474,900
Plain Macadam	72.9	464,460
Bridges		328,320
Total		\$30,778,480

T. H. Cutler, Jefferson City, Mo., is chief engineer state highway department.

Kansas

Construction work has progressed upon the state highway system until 62 per cent of the state highway system of 8,690 miles is now surfaced, of which 14 per cent is hard-surfaced (that is, brick, concrete, bituminous macadam or bituminous concrete).

There have been completed upon the state highway system since April, 1917, and up to Oct. 1, 1931, 480

miles of earth grade, not now surfaced (which will be graveled yet this fall); 4,086 miles of gravel and sand-gravel; 84 miles bituminous blotter treatment and bituminous surface mix (there will actually be 825 miles of this type of work in use this winter); 1,206 miles of hard surfaced road, making a total of 5,376 miles of roads on the state highway system now surfaced.

There was under contract and uncompleted upon Oct. 1: 524 miles of grading and culverts at a contract price of \$1,751,852, 102 miles of sand-gravel surfacing at a contract price of \$298,449, 651 miles of bituminous blotter treatment and bituminous surface mix at a contract price of \$999,632, 148 miles of hard surface at a contract price of \$3,984,896 and 205 bridges at a contract price of \$2,290,960, making the total price of uncompleted contracts \$9,325,791. Upon Oct. 1, 1931, there were reconstruction and regraveling contracts that were uncompleted, covering 915 miles at a contract price of \$548,426. A large percentage of this work is now completed. Upon Nov. 1, there still remained unearned on construction contracts \$2,463,693 and unearned upon reconstruction and regraveling contracts \$90,874.

For the 12-month period from Oct. 1, 1930, to September 31, 1931, there was expended for construction work upon the state highway system \$11,399,915. The work completed and accepted during this period consists of 141 miles of grading and culverts, not surfaced; 1,002 miles of gravel surface; 84 miles of bituminous blotter treatment; 107 miles of hard surfacing, making a total of 1,475 miles and 179 bridges.

During this same period, the state highway commission awarded contracts for 404 miles of grading at a contract price of \$3,139,003; 587 miles of gravel at a contract price of \$677,980; 657 miles of bituminous treatment at a contract price of \$1,032,000; 148 miles of hard surface at a contract price of \$3,983,537; and 175 bridges at a contract price of \$1,757,623; making a total of 1,796 miles of highway construction at a contract price of \$8,832,521 plus 175 bridges at a contract price of \$1,757,623, or a grand total of \$10,590,145.44.

On the construction work done during this last year, the state received from the Federal government emergency funds in the amount of \$2,192,301. Our Federal aid apportionment for 1932 is \$3,327,526, less one-fifth of the emergency fund as advanced us last year, or \$438,460, making our actual Federal aid as available for the calendar year 1932 \$2,889,065.80.

Construction work under the 1932 program contemplates the improvement of 635 miles of grading and culverts, 875 miles of gravel and bituminous surface roads, and 100 miles of hard-surfaced types.

W. V. Buck, Topeka, Kan., is state highway engineer.

Nebraska

The state highway work conducted in 1931 included 229 miles of concrete road, 1,230 miles of gravel roads and 699 miles of graded roads. The average cost of this work was as follows:

Types	Miles	Average Width Surfaced, Ft.	Thickness In.	Estimated Cost Per Mile
Concrete	229	20	9-7-9	\$17,800*
Gravel	1230	21-27	1½-3	1,750*
Graded	699	28-32	---	---
Oiled Sand	55	20-21	4-6	\$3,500-\$5,500

*Exclusive of Grading and Structures.

The probable expenditures for 1932 are approxi-

mately \$7,520,000, this and new construction proposed including the following:

Types	Miles
Concrete	126
Gravel	774
Graded and Drained	664
Oiled Sand	253

A. L. Lobdell, Lincoln, Neb., is Chief, Bureau of Roads and Bridges.

South Atlantic States

Delaware

Probable expenditure in 1932 for construction is \$2,350,000, which is about 20 per cent in excess of average of last four years.

W. W. Mack, Dover, Del., is chief engineer, state highway department.

North Carolina

At present time estimated expenditure for new construction in 1932 on state highways is \$4,000,000. If emergency federal fund is available expenditure will be increased. The estimated maintenance expenditures for next year are \$2,600,000 on state highways and \$6,000,000 on county highways.

L. R. Ames, Raleigh, N. C., is state highway engineer.

South Carolina

The fiscal year ending Sept. 30, 1931, was the most active year in the history of road building in South Carolina. During the year contracts were awarded for additional construction work estimated to cost approximately \$20,000,000. This represents approximately 500 miles of standard paving, 400 miles of bituminous surfacing, a number of miles of grading and earth type roads, and the necessary bridge work.

During the year actual construction completed was 674 miles of standard paving, 220 miles of bituminous surfacing, and a number of miles of earth type roads and bridges. The actual expenditures for construction during this period was \$24,029,478.

The status of the state highway system as of Sept. 30 was as follows:

	Miles
Standard Paving completed	2,114.3
Bituminous Surfacing completed	579.6
Improved earth types completed	1,837.7
Standard Paving under contract	236.8
Bituminous Surfacing under contract	351.9
Earth types under contract	242.7
Unimproved	628.7
Total	5,991.7

A definite construction program for the fiscal year ending Sept. 30, 1932, is not available at this time. The 1929 Highway Bond Act, under which the department is now operating, provides for the issuance of bonds or certificates of indebtedness, not to exceed the sum of \$65,000,000 or \$20,000,000 in any one year. On Sept. 30 only \$25,000,000 had actually been realized from this source with the state asking for bids on an additional \$10,000,000 on Dec. 23. This \$25,000,000, together with Federal Aid and other funds, has enabled the department to award contracts for approximately \$38,000,000. Of the work covered by these contracts there remained uncompleted on Sept. 30 approximately 237 miles of standard paving and 352 miles of bituminous surfacing. The unpaid balance on outstanding contracts was approximately \$10,500,000.

It is hoped that the state will be able to sell additional bonds sufficient for the department to undertake a program of approximately \$20,000,000 including the uncompleted portion of active contracts, or additional contracts totaling approximately \$9,500,000. The ex-

penditures of the department for maintenance during the fiscal year ending Sept. 30, 1931, was \$2,252,017.

Chas. H. Moorefield, Columbia, S. C., is state highway engineer.

Maryland

During the fiscal year state highway completed included 39 miles of penetration macadam, 107 miles of concrete, 14 miles bituminous surfacing, 66 miles of treated gravel and 60 miles of concrete shoulders. The state highway system under maintenance on Sept. 30 comprised the following:

Types	Mileage
Penetration Macadam	1,254.7
Concrete	1,420
Bituminous Surfacing	164.7
Untreated Gravel	217.4
Treated Gravel	390.2
Brick	1.26
Concrete Shoulders	828.9

The average cost per mile on the basis of 16 ft. width for the four major types constructed in 1931 was as follows:

P. C. Concrete	\$27,500
Plain Macadam	22,500
Gravel	10,200
Bituminous Macadam	21,000

The 1932 program has not been prepared at this writing. However the sum of approximately \$10,000,000 will be expended next year for new construction and reconstruction.

H. D. William, Jr., Baltimore, Md., is chief engineer State Roads Commission.

West Virginia

The principal types of state highway completed in 1931 were 129 miles of Portland cement concrete and 174 miles of bituminous macadam. Details of the work last year follow:

West Virginia State Highway Completed in 1931

Types	Miles	Average Width Sur- faced, Ft.	Thick- ness, In.	Estimated Average Cost per Mile
P. C. Concrete.....	129	18	7	\$20,598
Brick	0.93	18	3	8,100
Bituminous Concrete*	2.76	16	1½	13,674
Bituminous Macadam	174.53	18	10	20,576
Gravel	69.69	18	8	5,500
Bit. Treated Gravel & Stone.....	217.84	18	1½	4,274
Graded and Drained.....	122	30	---	17,240
Shale	49.49	18	Various	1,150
Stone Base	9.78	18	8	10,500

*Amiesite.

The uncompleted state highway construction carried over to 1932 included 136 miles of graded and drained road, 17 miles of concrete and 66 miles of stone base. The probable expenditure for the uncompleted portion is \$4,300,000.

Mileages and types of new construction for 1932 have not yet been decided upon, but the probable expenditure will be \$6,000,000. The expenditure for state maintenance will be \$3,000,000.

The average unit prices on the bids in 1931 were as follows:

Unclassified excavation, 40.2 ct.; broken stone base, \$3.23; class A concrete, \$13.45; class B concrete, \$13.02; metal reinforcement for structures, 4.92 ct.; metal reinf. for pavement, 4.03 ct.; cement concrete pavement, \$8.50; wire rope guard rail, 27.8 ct. erected; tar for retread, 12.9 ct.; asphaltic oil for retread, 10.5 ct.

E. G. Middleton, Charleston, W. Va., is Chief Engineer, State Road Commission.

Georgia

State highway completed in 1931 included 311 miles of concrete, 158 miles of bituminous macadam and 63 miles bituminous concrete. Details are given below:

Georgia State Highway Completed in 1931

Types	Miles	Average Width Sur- faced, Ft.	Thick- ness, In.	Estimated Average Cost per Mile
P. C. Concrete.....	311	20	9-6-9	\$18,000
Brick	3	20	---	22,000
Bituminous Concrete	63	20	Variable	17,000
Bituminous Macadam	158	20	---	14,000
Gravel	60	21	---	9,000
Graded and Drained.....	724	32	---	7,500
Limerock Base (Surface Treated)....	120	21	8	15,000
Sand-Asphalt	30	20	6	12,000

The uncompleted work carried over to 1932 included 42 miles of concrete, involving a probable expenditure of \$750,000; 36 miles limerock base, \$500,000; 11 miles sand-asphalt, \$130,000; 1 mile brick, \$20,000.

The proposed new construction for 1932 includes:

Types	Miles	Probable Expenditure
P. C. Concrete.....	265	\$5,000,000
Bituminous Concrete	174	2,500,000
Graded and Drained	250	2,000,000
Limerock Base	200	3,000,000
Sand-Asphalt	50	600,000

B. P. McWhorter, East Point, Ga., is state highway engineer.

Florida

State highway completed in 1931 included 170 miles of concrete, 11.4 miles asphalt macadam, 1.3 miles sand-clay, 183 miles graded and drained road, 145.4 miles rock base surface treated and 32 miles of sand-asphalt.

The uncompleted work carried over to 1932 included 265.9 miles of all types of paving, involving a probable expenditure of \$870,531; 190 miles of grading, involving a probable expenditure of \$1,234,960; and bridges involving a probable expenditure of \$369,947.

The estimated income for construction and maintenance in 1932 is approximately \$8,000,000.

B. M. Duncan, Tallahassee, Fla., is state highway engineer.

East South Central States

Alabama

State highway program as tentatively estimated at this time involves construction of 300 miles of all types of road. If additional funds are made available, program will be increased.

Landon G. Smith, Montgomery, Ala., is state highway director.

Kentucky

The following statement shows the major activities of the state highway commission between April 1, 1930 and Nov. 1, 1931:

CONSTRUCTION:	Miles	Contract Amount
Type		
Grade and Drain.....	589.590	\$ 5,129,953
Traffic Bound Macadam	378.344	2,731,278
Gravel	105.355	398,387
Water Bound Macadam	9.284	97,308
Surface Mix Treatment.....	52.571	653,093
Amiesite .....	.646	11,304
Rock Asphalt.....	122.480	2,585,295
Reinforced Concrete Paving	302.332	6,209,933
Bridges by separate contract (33).....	---	1,059,901
Total	1,560.602	18,876,456

TOLL BRIDGES:

The toll bridge program now under way includes ten bridges constructed entirely by the state highway commission of Kentucky and one constructed jointly by Kentucky and Indiana. Following is a list of these bridges:

Date Opened	Bridge	Contract Price Sub and Super
Aug. 10, 1931	Ashland-Ohio River Bridge.....	\$ 579,450
Nov. 25, 1931	Maysville-Ohio River Bridge.....	1,196,809
Nov. 12, 1931	Burnside-Cumberland River Bridge.....	190,656
Nov. 28, 1931	Smithland-Cumberland River Bridge.....	360,332
Nov. 11, 1931	Boonesboro-Kentucky River Bridge.....	175,696
Dec. 17, 1931	Spottsville-Green River Bridge.....	186,907
Approx. Date of Opening		
No date set	*Henderson-Evansville-Ohio River Bridge	1,582,995
Jan. 1, 1932	Canton-Cumberland River Bridge.....	373,160
Mar. 1, 1932	Eggnor's Ferry-Tennessee River Bridge	535,642
No date set	Paducah-Tennessee River Bridge.....	544,634
Mar. 1, 1932	Tyrone-Kentucky River Bridge.....	297,367

*Constructed jointly with Indiana.

MAINTENANCE:

Mileage of State Maintained Roads			
Types	April 1, 1930	November 1, 1931	
Grade and Drain.....	458.251	430.405	
Gravel.....	1,254.753	1,120.957	
Traffic Bound Macadam.....	819.618	1,230.700	
Traffic Bound Macadam Surf. Treat.....		10.533	
Retread or Surface Mix.....	115.286	260.144	
Water Bound Macadam.....	11.909	11.909	
Water Bound Macadam Surf. Treat.....	1,091.590	1,120.254	
Bituminous Macadam.....	205.085	196.498	
Rock Asphalt.....	193.520	280.500	
Bituminous Concrete.....	20.978	20.978	
Reinforced Concrete.....	301.907	590.304	
Brick.....	4.498	4.527	
Total.....	4,377.395	5,277.709	

Ben Johnson, Frankfort, Ky., is chairman, state highway commission.

West South Central States

Arkansas

State highway completed in 1931 included 260 miles of concrete road, 18 ft. wide, 9-6-9 in. thick, 40 miles, 18 ft. wide, 1½ in. thick, bituminous concrete and 100 miles, 20 ft. wide, 1½ in. bituminous treated roads.

The tentative program for new construction in 1932 includes 100 miles of concrete, 200 miles of gravel road, 100 miles of graded and drained road and 100 miles of bituminous treated road.

C. S. Christian, Little Rock, Ark., is state highway engineer.

Texas

During the fiscal year Sept. 1, 1930, to Aug. 31, 1931, the cost of state highway construction projects completed was \$25,293,763. In addition state highway bridges costing \$4,256,327 were completed. On Aug. 31 state highway projects to cost \$21,965,305 were under construction also state highway bridges costing \$3,888,939. The following is a summary of construction projects completed during the fiscal year Sept. 1, 1930, to Aug. 31, 1931, by types, showing mileage and cost.

Types of Highway	Original	Mileage Stage	Total	Cost
Grading and Structures.....	1,104.49	1.64	1,106.13	\$ 9,790,768
Gravel Surface.....	31.47	31.54	63.01	390,373
Shell Surface.....	5.21		5.21	53,886
Macadam Surface.....		15.42	15.42	164,240
Double or Triple Bit. Treatment on Caliche or Disintegrated Limestone.....	52.29	75.22	127.51	1,325,149
Double or Triple Bit. Treatment on Gravel.....	3.19	34.60	37.79	271,724
Double or Triple Bit. Treatment on Macadam.....		15.09	15.09	207,085
Limestone Rock Asphalt on Concrete.....		5.20	5.20	115,791
Two Course Rock Asphalt on Gravel.....		73.78	73.78	981,121
Two Course Rock Asphalt on Macadam.....		6.62	6.62	24,675
Two Course Rock Asphalt on Concrete.....		9.55	9.55	210,337
Asphaltic Concrete on Concrete.....	.45		.45	12,408
Concrete Pavement—Reinforced.....	108.73	357.33	466.06	11,606,322
Brick on Macadam with concrete shoulders.....	1.68		1.68	102,861
Brick on Concrete.....	.95		.95	37,016
	*1,308.46	†625.99	1,934.45	\$25,293,763
Bridges				
Concrete.....				\$ 124,938
Concrete and Timber.....				49,357
Concrete and Steel.....				2,710,854
Steel.....				100,000
Timber—Treated.....				12,322
Steel and Timber.....				303,154
Steel, Concrete and Timber.....				955,699
				\$ 4,256,327
Total.....				\$29,550,090
Federal Funds.....	23.35%			\$ 6,898,649
State Funds.....	41.45%			12,248,124
County Funds.....	34.01%			10,051,548
Other Funds.....	1.19%			351,767
Total.....	100.00%			\$29,550,090

*Denotes initial improvement on unimproved highways.
†Denotes additional improvement on highways where initial improvement has been completed.

A summary statement of projects under construction

as of Aug. 31, 1931, by types, showing mileage cost follows:

Type of Highways	Original	Mileage Stage	Total	Cost
Grading and Structures.....	1,082.61		1,082.61	\$ 7,109,287
Caliche or Disintegrated Limestone.....		10.65	10.65	50,404
Macadam Surface.....		11.35	11.35	107,721
Double or Triple Bit. Treatment on Caliche or Disintegrated Limestone.....		59.08	59.08	474,513
Double or Triple Bit. Treatment on Gravel.....		82.97	82.97	679,748
Double or Triple Bit. Treatment on Macadam.....		99.61	99.61	915,764
Limestone Rock Asphalt on Concrete.....		7.31	7.31	153,960
Two Course Rock Asphalt on Gravel.....	2.74	26.47	29.21	273,436
Two Course Rock Asphalt on Macadam.....		16.03	16.03	224,333
Sheet Asphalt Pavement on Concrete.....		4.28	4.28	112,161
Concrete Pavement—reinforced.....	124.78	485.72	610.50	11,863,972
	*1,210.13	†803.47	2,013.60	\$21,965,305
Bridges				
Concrete and Timber.....				\$ 46,434
Concrete and Steel.....				3,086,136
Timber—Treated.....				85,219
Steel, Concrete and Timber.....				664,148
				\$ 3,881,939
Grand Total.....				\$25,847,244

*Denotes initial improvement on unimproved highways.

†Denotes additional improvement on highways where initial improvement has been completed.

Note: Cost based on estimated quantities at contract prices.

The definite program for 1932 has not been decided upon at this writing, but it probably will be approximately equal to the work completed in 1931.

Gibb Gilchrist, Austin, Tex., is state highway engineer.

Louisiana

State highway work completed in 1931 included the following: Grading and drainage structures without surfacing, 538 miles; grading and drainage structures with surfacing, 1,027 miles; intermediate types asphalt pavement, 612 miles; concrete pavement 8-6-8 section, 18 ft. wide, 1,067 miles. In addition 31 projects for bridges ranging in cost from \$20,000 to \$1,200,000 were let as separate contracts.

Of the \$75,000,000 bond issue \$35,000,000 of bonds were sold. The balance is available for use when sold.

H. B. Henderlite, Baton Rouge, La., is state highway engineer.

Mountain States

Wyoming

A total of 1,450 miles of state highway work was completed in 1931, this including 596 miles of oil treatment, 502 miles of gravel and 352 miles of graded and drained road. Details of this work follow:

Wyoming State Highways Completed in 1931

Types	Miles	Average Width Surfed, Ft.	Thickness, In.	Est. Av. Cost per Mi.
Oil Treatment.....	596	20	4-6	\$3,500
Gravel.....	502	20	4-6	1,800
Graded and Drained.....	352	24		4,500

The proposed new construction for 1932 will require a probable expenditure of \$3,600,000 and will include 520 miles of oil treatment, 514 miles of gravel road and 147 miles of graded and drained road.

Z. E. Sevison, Cheyenne, Wyo., is state highway engineer.

New Mexico

A total of 344 miles of all classes of state highway was completed in 1931. Details of the work follows:

New Mexico Federal Aid Emergency State Highway Completed in 1931

Types	Miles	Average Width Sur- faced, Ft.	Thick- ness, In.	Average Cost per Mile
*Oil-Processed	132	20	3	\$ 6,781
†Gravel (Top or Base Course)	130	20	5 & 6	15,035
Graded and Drained	82	....	..	18,610

*Oil-Processed on previously constructed projects.

†Includes 48 miles surfacing only on previously constructed projects.

The uncompleted state highway work carried over to 1932 included 12.34 miles of grading and base course, involving a probable expenditure of \$213,523.

The tentatively proposed new construction (Federal Aid) for 1932 is as follows:

Types	Miles	Probable Expenditure
P. C. Concrete	4.0	\$ 111,900
Oil-Processing	172.0	1,061,350
Gravel	134.7	1,588,950
Graded and Drained	11.4	268,000

The accompanying tabulation shows the unit prices bid on projects awarded during 1930 and on projects in 1931 emergency programs.

W. R. Eccles, Santa Fe, N. Mex., is state highway engineer.

Montana

State highway completed in 1931 included 931 miles of 18 ft. 8 in. thick gravel roads, 623 miles of graded and drained roads and 305 miles, 18 ft. 1 in. to 3 in. bituminous treatment at an average cost of \$2,000 per mile. The uncompleted work carried over to 1932 comprised 187 miles of grading and drainage involving a probable expenditure of \$800,000.

The proposed new construction for 1932 includes 300 miles of gravel road requiring a probable expenditure of \$1,000,000; 300 miles of graded and drained road requiring a probable expenditure of \$2,000,000 and 1 mile of bridges to cost about \$1,000,000.

R. D. Rader, Helena, Mont., is state highway engineer.

Utah

Construction program for 1932 estimated to call for expenditure of \$2,750,000. Work includes 120 miles grading new roads, 50 miles gravel surface, 250 miles

Unit Prices Bid on Projects Awarded During 1930 and Projects in Emergency Program

1930

Item	Unit	Quantity	Average Unit Price	1931 Emergency Projects Quantity	Average Unit Price
Clearing and Grubbing	Acre	89	\$ 25.96	486.8	\$ 25.07
Excavation Unclassified	Cu. Yd.	803,196	0.29	358,061	0.32
Excavation Common	Cu. Yd.	58,640	0.20	768,356	0.26
Excavation Solid Rock	Cu. Yd.	44,744	1.27	194,233	0.94
Excavation for Structures	Cu. Yd.	19,562	1.79	17,762	0.85
Excavation for Strs. (Bridges)	Cu. Yd.	2,469	1.49	32,891	1.18
Excavation for Pipe Culverts	Cu. Yd.	.....	.....	4,316	0.73
Channel Excavation, Common	Cu. Yd.	.....	.....	212,630	0.26
Channel Excavation, Solid Rock	Cu. Yd.	.....	.....	13,124	1.16
Earth Cushion, Rock Cuts and Fills	Cu. Yd.	.....	.....	30,523	0.37
Excavation for Bank Prot.	Cu. Yd.	2,649	1.47	2,874	0.58
Borrow Unclassified	Cu. Yd.	2,000	0.60	.....	.....
Borrow Common	Cu. Yd.	1,949,900	0.21	1,706,233	0.20
Earth Fill	Cu. Yd.	369	0.35	.....	.....
Approach Fill (U. Abut.)	Cu. Yd.	3,647	0.60	1,190	0.40
Rock Fill	Cu. Yd.	359	2.35	.....	.....
Overhaul	Sta. Yd.	1,209,588	0.03	2,360,173	0.023
Overhaul	1/4 Mi. Yd.	.....	.....	737,529	0.06
Overhaul	1/4 Mi. Yd.	72,008	0.25	.....	.....
Scar and Resh Surface Course	Station	156,804	55.40	76.9	52.52
Finish Earth Graded Roads	Cu. Yd.	64,979	0.34	4,357	2.01
Surface Plating Course	Cu. Yd.	119,825	1.34	47,666	0.28
Crushed Sel Mat Base Course	Cu. Yd.	125,772	1.61	58,921	1.47
Cr. Gravel Base Course	Cu. Yd.	544	2.11	105,039	1.54
Cr. Rock Base Course	Cu. Yd.	158,055	1.51	26,211	1.47
Cr. Sel Mat Surface Course	Cu. Yd.	172,202	1.35	23,873	1.99
Cr. Gravel Surface Course	Cu. Yd.	26,659	1.83	47,260	1.64
Cr. Rock Surface Course	Cu. Yd.	56,264	1.31	.....	.....
Pit Run Surface Course	Cu. Yd.	20,095	0.63	14,859	0.56
Binder	Cu. Yd.	207	1.03	.....	.....
Binder (Bridges)	Sq. Yd.	20,457	2.25	.....	.....
Concrete Paving	Sq. Yd.	786	2.75	480	1.30
Concrete Paving (Spillways)	Cu. Yd.	36	19.00	24	23.00
Cl. "B" Conc. (Spillways)	Cu. Yd.	8,638.9	20.44	15,790	21.26
Cl. "A" Conc. Box Culv. and Syph.	Cu. Yd.	598.8	22.07	1,382	23.18
Cl. "B" Conc. Mtl. Culv. Pipe Hdwl.	Cu. Yd.	63.5	36.00	33	42.00
Cl. "D" Conc. Superstructure	Cu. Yd.	6,521.6	18.91	8,395	21.16
Cl. "A" Conc. Substructure	Cu. Yd.	3,419.9	19.30	1,848	22.00
Cl. "A" Conc. Superstructure	Cu. Yd.	3,455	8.91	825	9.34
Mortar Rubble Masonry	Cu. Yd.	385	4.93	1,443	3.22
Riprap	Each	28	19.25	33	21.24
Conc. Mon. and Markers	Each	405	3.08	2,489	2.95
Right of Way Markers	Lb.	1,244,345	0.048	1,117,069	0.05
Reinforcing Steel (Bridges)	Lb.	923,525	0.052	1,787,671	0.051
Rein. Stl. Con. Culv. and Syphons	Lb.	15,901	0.058	40,236	0.055
Rein. Stl. Hdwl. and Spillways	Lb.	3,004,296	0.041	1,178,577	0.05
Structural Steel	Lin. Ft.	864	2.42	192	2.25
18 In. C. G. M. Pipe	Lin. Ft.	10,194	2.79	12,309	2.51
24 In. C. G. M. Pipe	Lin. Ft.	2,788	3.36	5,850	3.30
30 In. C. G. M. Pipe	Lin. Ft.	1,176	5.75	6,970	4.69
36 In. C. G. M. Pipe	Lin. Ft.	54	10.00	.....	.....
48 In. C. G. M. Pipe	Lin. Ft.	1,948	0.10	.....	.....
Galvanized Wire Mesh	Lin. Ft.	7,395	0.97	6,396	0.96
Woven Wire Guard Fence	Lin. Ft.	10,775	0.93	8,223	0.99
Woven Wire Bridge Railing	Lin. Ft.	26,622	0.14	2,093	0.09
Woven Wire Farm Fence	Lin. Ft.	762,359	0.047	1,449,167	0.048
Galv. Barbed Wire Fence	Each	.....	.....	4,708	1.50
Bracing Fences	Lin. Ft.	96,597	0.024	7,558	0.026
Reconstructed Fence	Each	257	16.79	566	15.50
Gates	Each	.....	.....	.....	.....
Cattle Guard	Each	.....	.....	.....	.....
Treated Timber Superstructure	M. B. M.	1,295,055	135.34	953.7	127.79
Treated Timber Substructure	M. B. M.	258,866	137.45	212.6	125.21
Untreated Timber	M. B. M.	.....	80.00	29.2	119.77
Treated Timber Piling	Lin. Ft.	55,763	1.31	30,075	1.31
Piling Bank Protection	Lin. Ft.	11,595	1.38	11,633	1.44
Wire Bank Protect. (Fabric)	Lb.	15,867	0.17	32,812	0.12
Brush and Rock Bank Protect.	Cu. Yd.	5,035	2.14	5,748	1.97
Protection Ditch and Dyke	Cu. Yd.	1,777	0.20	.....	.....
Rolling Base Course	Hours	.....	.....	2,686	2.53
Maintenance Base and Roadbed	Miles	.....	.....	123.3	52.58
Additional Filler	Cu. Yd.	.....	.....	21,520	0.16
Premixed Oil Surfacing	Tons	.....	.....	181,946	3.01
Watering Base Course	M. Gal.	.....	.....	3,883.6	2.53
All Gravel	Cu. Yd.	654,265	1.455	261,304	1.575

oiling and 5 miles paving. The above expenditure includes bridges. The cost of maintenance and miscellaneous work will be about \$1,350,000.

H. S. Kerr, Salt Lake City, Utah, is chief engineer, state road commission.

Idaho

State highway completed in 1931 included 362 miles of gravel or crushed rock road and 176 miles of bituminous treatment on gravel or crushed rock. Details of the work follows:

Idaho State Highway Completed in 1931				
Types	Miles	Average Width Sur- faced, Ft.	Thickness In.	Estimated Aver. Cost Per Mile
Gravel or Crushed Rock.....	362	18	6	\$2,950
Graded and Drained.....	35	24*	---	4,521
Bituminous Treated.....	176	18	2½	3,022

*Shoulder width.

The uncompleted state highway carried over to 1932 included 42 miles of gravel or crushed rock road calling for a probable expenditure of \$260,000; and 3½ miles of bituminous concrete involving a probable expenditure of \$50,000.

The proposed new construction for 1932 calls for a probable expenditure of \$2,600,000.

G. E. McKelvey, Boise, Idaho, is acting commissioner of public works.

Pacific States

Washington

State highway completed in 1931 included 104.5 miles of concrete 153 miles of gravel road and 103 miles of graded and drained road. Details of the work follow:

Washington State Highways Completed in 1931				
Types	Miles	Average Width Sur- faced, Ft.	Thick- ness, In.	Estimated Average Cost per Mile
P. C. Concrete.....	104.54	20	10-7 ½-9	\$28,341
Bituminous Macadam.....	33.8	20	2½*	1,123
Gravel.....	152.78	18	7*	6,977
Seal Coat Oiling.....	685.1	20	¾*	870
Graded and Drained.....	103.57	30	---	16,015
Heavy Bit. Treatment.....	200.00	---	---	---

*Average thickness.

The uncompleted state highway carried over to 1932 included 62.15 miles of graded road, 129.2 miles of surfaced and 1.43 miles of concrete. The probable expenditure is \$1,500,000.

The proposed new construction for 1932 includes the following:

Types	Miles
P. C. Concrete.....	90
Bituminous Macadam.....	48
Plain Macadam.....	190
Graded and Drained (without Surfacing).....	80
Light Oiling (Dust Palliative).....	563
Heavy Bituminous Treatment.....	164

Samuel J. Hume, Olympia, Wash., is state highway engineer.

California

State highway completed in 1931 amounted to 731 miles and included the following:

California State Highway Completed in 1931				
Types	Miles	Average Width Sur- faced, Ft.	Thickness In.	Estimated Aver. Cost Per Mile
P. C. Concrete.....	113	20	9-7-9	\$43,160
Bituminous Concrete.....	68	20	6	34,900
Bituminous Macadam.....	37	20	---	23,660
Untreated Crushed Gravel or Stone Surface.....	105	---	---	14,500
Oil Treated Crushed Gravel or Stone.....	408	20	---	18,100

The uncompleted state highway carried over to 1932 included 92 miles of P. C. concrete, 31 miles of asphaltic concrete, 14 miles bituminous macadam, 42 miles untreated macadam, 208 miles oil treated macadam and

60 miles of grading. The probable expenditure of \$14,600,000, comes the estimated cost of the work now underway including 35 bridges.

The proposed new construction for 1932 calls for a probable expenditure of \$23,000,000, the work including 30 bridges, 410 miles of paving, 160 miles untreated surfacing and 50 miles of grading. During 1931 the average bid price for grading was 27 ct. per cubic yard, for portland cement concrete pavement \$7.43 per cubic yard, and for asphalt concrete \$3.35 per ton. Grading included all classes of excavation without classification from mountainous sections to valley sections. For portland cement concrete pavement separate bids were taken for reinforcing steel and for subgrade. For asphalt concrete separate bids were taken for subgrade.

C. H. Purcell, Sacramento, Calif., is state highway engineer.

Oregon

The accompanying tabulation gives some details of the state highway work completed in 1931.

Types	Miles	Average Width Sur- faced, Ft.	Thick- ness, In.	Estimated Average Cost per Mile
P. C. Concrete.....	5	20	7	\$25,000
Bituminous Macadam.....	120	20	2	4,000
Plain Macadam.....	130	20	10	6,000
Graded and Drained.....	200	30	---	15,000
Bituminous Surface Treatment.....	430	20	¾	1,500

The uncompleted work carried over to 1932 includes 5 miles of plain macadam involving a probable expenditure of \$30,000 and 50 miles of graded and drained road involving a probable expenditure of \$300,000.

The program for new construction in 1932 has not yet been formulated.

Roy A. Klein, Salem, Ore., is state highway engineer.

ESTIMATED COUNTY ROAD & BRIDGE EXPENDITURES FOR 1932

State and County	Construction	Maintenance	Total
ALABAMA:			
Mobile.....	\$ 500,000	\$ 200,000	\$ 700,000
ARIZONA:			
Pima.....	30,000	90,000	120,000
CALIFORNIA:			
Napa.....	100,000	50,000	150,000
Siskiyou.....	18,510	189,535	208,045
COLORADO:			
La Plata.....	12,000	40,000	52,000
Lincoln.....	20,000	45,000	65,000
DELAWARE:			
Kent.....	75,000	---	75,000
GEORGIA:			
Calhoun.....	10,000	15,000	25,000
Jefferson.....	---	12,000	12,000
Jones.....	25,000	25,000	50,000
ILLINOIS:			
Brown.....	20,000	4,000	24,000
Bureau.....	100,000	20,000	120,000
Greene.....	34,000	24,000	58,000
Ogle.....	65,000	25,000	90,000
White.....	25,000	1,500	26,500
Woodford.....	57,500	2,500	60,000
INDIANA:			
Blackford.....	3,000	30,000	33,000
Davies.....	8,000	57,000	65,000
Howard.....	---	75,000	75,000
La Grange.....	---	30,000	30,000
Pike.....	---	28,000	28,000
Warren.....	16,000	45,000	61,000
Wells.....	---	76,000	76,000
IOWA:			
Adams.....	40,000	80,000	120,000
Buena Vista.....	72,000	70,000	142,000
Clinton.....	170,000	120,000	290,000
Dallas.....	107,160	149,052	256,212
Dickinson.....	34,000	45,000	79,000
Dubuque.....	110,000	90,000	200,000
Floyd.....	76,000	77,000	153,000

State and County	Construction	Maintenance	Total	State and County	Construction	Maintenance	Total
Franklin	78,074	99,465	177,540	Ravalli	12,000	36,000	48,000
Jackson	53,364	90,152	143,516	NEBRASKA:			
Johnson	180,300	140,000	320,300	Fillmore	15,000	12,000	27,000
Monroe	50,000	80,000	130,000	Saunders	110,000	50,000	160,000
Page	60,000	118,000	178,000	NEVADA:			
Pottawattamie	127,000	233,000	360,000	Elko	60,000		60,000
Sioux	79,000	78,000	157,000	NEW JERSEY:			
Tama	{ T 91,000			Gloucester	120,000	230,000	350,000
	{ L 50,000	142,000	283,000	Salem			175,000
KANSAS:				Sussex	250,000	250,000	500,000
Barton	90,000	30,000	120,000	NEW YORK:			
Chase	50,000	30,000	80,000	Cattarrangus	300,000	75,000	375,000
Cherokee	68,000	60,000	128,000	Madison	250,000	80,000	330,000
Crawford	10,000	15,000	25,000	Schuyler	40,000	40,000	80,000
Decatur		25,000	25,000	Washington	220,000	35,000	255,000
Elk	35,000	20,000	55,000	Wyoming	200,000	75,000	275,000
Hamilton	18,000	11,000	29,000	NORTH DAKOTA:			
Jefferson		65,000	65,000	Barnes	85,000	15,000	100,000
Leavenworth		20,000	20,000	Eddy	40,000	4,000	44,000
Logan	18,000	1,800	19,800	Williams	20,000	20,000	40,000
Marion	30,000	16,000	46,000	OHIO:			
McPherson	81,600	30,000	111,600	Clark		180,000	180,000
Meade	2,500	13,000	15,500	Fairfield			180,000
Mitchell	20,500	20,500	41,000	Greene	35,000	44,000	79,000
Nemaha	25,000	25,000	50,000	Huron	34,900	157,540	192,440
Reno	30,000	100,000	130,000	Seneca	48,000	108,000	156,000
Riley	{ Bridge 44,000			Washington	20,000	65,000	85,000
	{ Road 34,000	28,000	106,000	OKLAHOMA:			
Saline	{ Bridge 37,500	25,000	105,000	Cleveland	15,000	65,000	80,000
	{ Mach. 2,000			Lincoln	15,000	35,000	50,000
Trego	{ 10,000	7,500	19,500	Okmulgee	110,000	50,000	160,000
Wichita	15,000	8,000	23,000	Pittsburg			90,000
Wilson	26,000	20,000	46,000	OREGON:			
KENTUCKY:				Lincoln	141,000	20,000	161,000
Edmondson	25,000	4,000	29,000	PENNSYLVANIA:			
Henry	12,000	22,000	34,000	Mercer	10,000		10,000
Logan	20,000	20,000	40,000	SOUTH DAKOTA:			
Mason	30,000	30,000	60,000	Beadle	60,000	20,000	80,000
Nelson	60,000	60,000	120,000	McCook	30,000	10,000	40,000
Pike	65,000	20,000	85,000	Moody	25,000	25,000	50,000
LOUISIANA:				Spink	27,000	12,000	39,000
Bossier	35,000	20,000	55,000	TENNESSEE:			
Caddo Parish	115,000	215,000	330,000	Dyer	5,000	50,000	55,000
Lincoln	40,000	10,000	50,000	Humphreys	19,000	18,000	37,000
Morehouse Parish	50,000	50,000	100,000	TEXAS:			
Sabine		42,000	42,000	Childress		16,000	16,000
MASSACHUSETTS:				Culberson		1,200	1,200
Worcester	275,000	25,000	300,000	Dallas	975,000	380,000	1,355,000
MICHIGAN:				El Paso	615,000	175,000	790,000
Gogebic	118,000	87,000	205,000	Harris	1,000,000	500,000	1,500,000
Lapeer		60,000	60,000	Jones	15,000	25,000	40,000
Luce	20,000	30,000	50,000	Matagorda	900,000	100,000	1,000,000
Manistee	30,000	40,000	70,000	Motley	50,000	9,000	59,000
Menominee	90,315	82,802	173,117	State Resident	450,000	30,000	480,000
St. Joseph	16,000	85,000	101,000	Wharton	200,000	135,000	335,000
Washtenaw	8,000	47,000	55,000	Wise		30,000	30,000
MINNESOTA:				UTAH:			
Aitkin	60,000	20,000	80,000	Utah	60,000	50,000	110,000
Blue Earth	80,000	45,000	125,000	VIRGINIA:			
Jackson	100,000	55,000	155,000	Albemarle	40,000	80,000	120,000
Koochiching	15,000	20,000	35,000	Northampton	6,000	3,000	9,000
Olmstead	110,000	50,000	160,000	WASHINGTON:			
Rock	50,000	15,000	65,000	Benton	70,000	60,000	130,000
Todd	140,000	40,000	180,000	Clark	150,000	150,000	300,000
		{ 40,000*		Ferry	50,000	25,000	75,000
Wabasha	40,000	{ 40,000	120,000	Grays Harbor	225,000	250,000	475,000
Waseca	115,000	25,000	140,000	Klickitat	70,000	50,000	120,000
Watsonwan	65,000	22,000	87,000	Lincoln	181,405	47,834	229,239
Yellow Medicine	50,000	45,000	95,000	Okanogan	125,000	10,000	135,000
MISSISSIPPI:				Spokane	149,798	91,365	241,163
Lowndes	30,000	48,000	78,000	Whitman	150,000	60,000	210,000
Webster	50,000	100,000	150,000	WEST VIRGINIA:			
MISSOURI:				Supt. of Highways	80,000	30,000	110,000
Clinton	40,000	22,000	62,000	Harrison	100,000	90,000	190,000
Dallas	12,000		12,000	Ohio	147,736	121,912	269,648
Franklin	83,000	3,000	86,000	Wood	75,000	5,000	80,000
Jasper			165,000	WISCONSIN:			
Ozark	15,000	20,000	35,000	Burnett	20,000	16,000	36,000
Polk	42,267	5,000	47,267	Lincoln	40,000	50,000	90,000
Ralls	50,000	5,000	55,000	Marquette	19,211	21,298	40,509
MONTANA:				Polk	49,000	27,000	76,000
Beaverhead	15,000	40,000	55,000	Vernon	215,000	170,209	385,209
Chouteau	35,000	30,000	65,000	WYOMING:			
Glacier	35,000	6,000	41,000	Goshen	15,000	18,000	33,000
Liberty		4,000	4,000				

*Retiring warrants.

OHIO BRICK PAVEMENT

Rubber expansion joint filler tried



Concrete Base for Brick Pavement, 5 In. by 18 In. Sandstone Curb in Place



Screed Is Mounted on Small Wheels and Adjusted to Depth of Cushion

UNUSUAL rapid progress as well as an improved quality of construction featured the Ohio state highway department's 1931 highway and bridge work.

Brick pavements and other popular types of modern pavements came in for a generous share of the state's 1931 program. The program was a varied one, calling for many miles of reconstruction which involved the salvaging of the old pavement metal by widening on each side and resurfacing over all, to the new construction of the standard 20 foot width pavement and the super-highway of 50 foot width with heavy base, located in the suburban districts.

One of Ohio's 1931 super-highway improvements worthy of special mention was the construction of a 50-foot width pavement on U. S. No. 40, the National Road, through the eastern portion of Columbus and the Village of Bexley.

This improvement was scheduled for 1932, but owing to improvements going on farther east which already necessitated a 22 mile detour for through traffic, the plans, finances



Setting Curbing on 50 Foot National Old Trail

CONSTRUCTION PICTURED

out first time on paving job

and sale of this particular section, was rushed forward and the work actually completed in the late months of 1931, thus ending for many years to come the problem of detours on account of construction of any part of U. S. No. 40 between Columbus and Hebron, Ohio, a distance of $27\frac{1}{2}$ miles. In other words what ordinarily would have been three years of construction work on this important artery, was concentrated into one year, the main purpose of which was not to subject traffic to the inconvenience of detours for a period of years.

Pictures of this work are shown with the cross sections below. Although state specifications permitted a bituminous joint filler material, a rubber expansion joint filler was used instead. This is the first job to use this type of joint material.

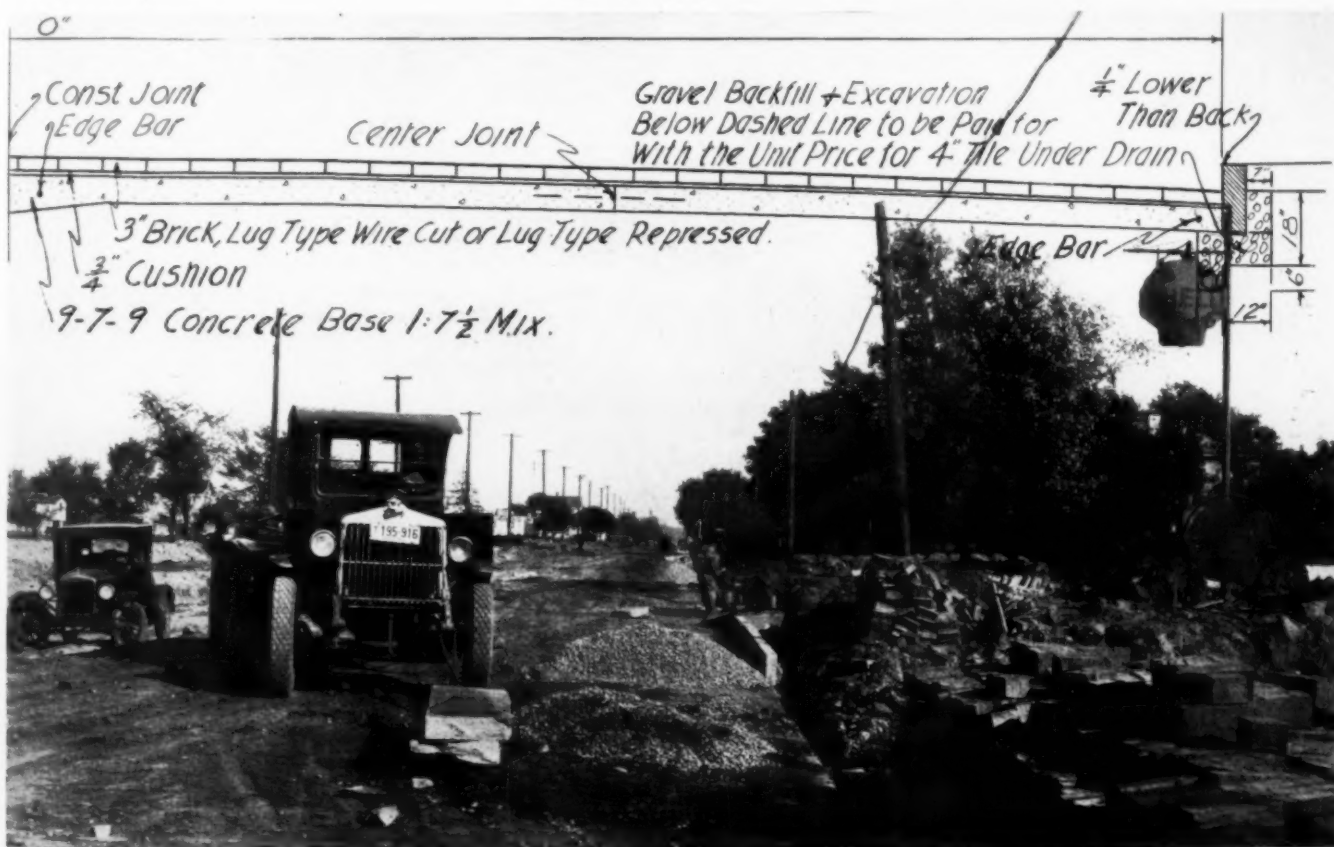
Another route, only 34 ft. 6 in. wide, is shown in the pictures alongside this text matter. These construction views show some of the various angles of a brick paving job. The sand cushion leveling screed of the type shown is a tool not seen on most brick jobs.



Luting the Sand Cushion Is the Final Operation Before Dropping the Brick



Each and Every Brick in a Brick Paving Job Is Individually Handled



Filling National Old Trail Brick Surface with Asphalt

Pictures by Courtesy of Ohio Department of Highways

Virginia

Improves Surface Treatment Methods

By G. A. McCLELLAN
The Texas Company

FOR the past several years, the bituminous surface treatment of sand-clay, gravel, topsoil, and macadam roads has been of increasing importance in Virginia. During the present season, the Virginia State Highway Commission will have used in this work, upwards of 13,000,000 gal. of outbreak asphaltic oil covering a wide variety of surfaces and conditions.



Close-up of multiple-blade road planer mixing Texaco asphalt cutback material and stone

Up to this year the old method of applying about one-third gal. of asphaltic material followed by about 35 lb. of cover stone per sq. yd. and rolling has been followed. While the results obtained in this manner have been excellent indeed, and an enormous improvement noted over the old untreated roads, it has been found that with modern traffic at present high speeds, there exist certain irregularities which are unavoidable when constructed by the old methods and which render such high speed traffic unpleasant and at times unsafe. A method of reducing such irregularities without any considerable increase in cost was sought and at least partially obtained in the following simple manner.

On retreatment, or second course treatment work, instead of first applying asphalt and covering with stone, the stone is applied first at the rate of 40 to 45 lb. per sq. yd. The asphalt, which in Virginia is a cutback containing about 65 per cent of 85 to 100 penetration asphalt, is then applied at the rate of one-third gal. per sq. yd. at as high pressure at the nozzles as is obtainable. The whole is then dragged with a multiple blade road planer such as was originally designed for earth road maintenance; the sole change being that the rear wheels are behind instead of in front of the strike off blade. This gives the rear wheels an even surface to ride upon. The surface is then rolled in the usual manner.

The advantages gained by this method are as follows:

First and most important, an immeasurably more uniform and better riding road surface is secured. De-

pressions and humps of nearly two inches are leveled and eradicated.

Second, more than five lb. of stone per sq. yd., using the same amount of asphalt, are forced into the road surface over and above that required by the old method. This adds to the thickness and durability of the treatment.

Third, each stone receives a coating of asphalt and for this reason none is thrown off the road by traffic before consolidation. By the old method, a considerable percentage of stone was kicked from the road and lost.

The cost of this method has been found to add less than 100 dollars per mile to the old process, not including the cost of additional stone. The only additional equipment required is one multiple blade road planer and three extra men.

The progress of the work is speeded rather than slowed, since the men engaged in spreading stone may work continuously instead of waiting on the asphalt distributor between loads.

The results now being obtained by this simple change in method are so remarkably superior to those of methods in use heretofore, that engineers of the Virginia State Highway Commission regard it as one of the most valuable and important developments made in highway construction, in their state in recent years.



View which shows the granular, non-skid surface obtained by full stone content on section of Virginia highway

Historic Mt. Vernon Highway to be Lighted

Symbolizing the progress made by the nation he helped to create, the famous highway leading to the Mt. Vernon home of George Washington, will soon be illuminated.

Proposals for bids for the construction of a complete highway lighting system for the new Mt. Vernon Boulevard have been sent out by the government. The boulevard, nearing completion, extends from Washington, D. C., to America's most popular historic shrine, in Virginia. It will be one of the best illuminated highways in the country. With thousands of visitors from every state travelling over this route, the lighting installation is expected to prove a stimulus to highway lighting in other parts of the nation.

RECENT DEVELOPMENTS

Maintaining Concrete Pavements

By C. N. CONNER

Associate Editor

BYOND a doubt the use of the "mud-jack" is the outstanding development in concrete pavement maintenance in 1931. In December, 1930, Mr. W. H. Root presented to the annual meeting of the Highway Research Board in Washington the first information concerning the use of a piece of equipment developed by Mr. John Poulter of Mt. Pleasant, Iowa, called, at that time, a mud pump.

During 1930, Mr. Poulter, in cooperation with the highway departments of Iowa and Illinois, had been successful in developing a new method of eliminating dips in concrete pavement by the forcing of mud mixed with a small amount of cement, under the slab.

During 1931 the work has been continued through the cooperation of the National Equipment Corporation, with which Mr. Poulter associated himself, and various highway departments. The methods used in 1931 have not been materially different from those developed in 1930, but the ramifications of the work are such as to make a progress report of interest.

Fifty-five new users have come in contact with this method of maintaining concrete pavement, two state highway departments having equipped themselves with ten machines each.

The experiences covered in what follows have been gleaned from the use of this machine from Coast to Coast and from the Canadian to the Mexican Border.

It is apparent that the mud-jack has offered an opportunity for the saving of many miles of rigid highway from failure due to conditions below the slab, conditions over which the engineers and the contractors who built the roads have no control. Water, freezing, thaw-

A discussion of the conditions actually met during 1931 and overcome, will bring out points of value to those responsible for the maintenance of highways. The roads that were maintained by this method have a great variation in density of traffic and condition of supporting soils.

Experience in New York.—The first example is Sunrise Highway on Long Island, carrying the freight and passenger traffic of this densely populated district into Brooklyn and the rest of New York City. Great care was taken in the construction of this pavement. It consists of a forty foot pavement, placed in four lanes with contraction joint between and with transverse joints every eighty feet. The traffic on each lane is one-way traffic with the result that within two years the heavy traffic had subjected the concrete slab to tremendous impact as the trucks rolled off of one slab across the transverse joint onto the other. For a distance of sixteen miles the end of the slab receiving the impact was below the end of the adjacent slab a distance of one-half to five inches. The impact had been sufficient to displace the sand subgrade and allow the settlement of the slab.



Mud-Jack for City Streets

ing, and weathering are all factors in the lack of stability of earth work and the question of placing a rigid slab on top of a constantly moving earth support has been one of the problems of design that has faced the construction industry. Experience covering twenty years has shown that it is extremely difficult to get uniform bearing even under the most desirable circumstances for such a slab.



Showing the Proper Steel for Drilling 2½-In. Hole in Slab. A Six-Point Drill on 1-In. Steel, 24 In. Long

During 1930 this road had been maintained by the placing of a bituminous mixture at these points, but in 1931 this material was taken off of the pavement and the settled portion of the slabs brought back to the gradient of the remainder of the road. The methods employed in the handling of this project consisted of the releasing of end pressures by the cutting out of

concrete at the joint and the drilling of three or more holes $2\frac{1}{2}$ in. in diameter through the slab. Two of these holes were drilled approximately two feet from each edge of the ten foot strip at two feet back from the joint, with the third hole at the middle of the slab approximately ten feet from the joint. These dimensions were varied depending on the conditions found on the individual slab.

The material forced under the slab consisted of sandy loam top soil found along the highway. This was mixed with approximately a bag of concrete to the cubic yard of earth and with sufficient water to bring it to the consistency desired.

With one mud-jack it was possible to raise a joint in from one-half to three hours.

An inspection of the road made two months after the work was first done showed that the slab was remain-

essential on this highway because of the very unusual conditions, but yet by the use of this tool it is practical to main a rigid type of pavement on unstable earth work.

Water is the enemy of stability of earth work. The seepage of water through embankments, particularly back of bridge abutments, displaces the earth, changes its volume, and in turn a void develops.

Although many conditions have come to attention this year of pumping mud under slabs at bridge abutments, perhaps the outstanding example of this work was carried on at Montville, Pa., where a highway consisting of two 9-foot slabs and a $7\frac{1}{2}$ -foot slab carrying a street car track, crosses the Pennsylvania Railroad on a viaduct. The pavement was depressed a maximum of six inches at one edge and the track pavement about two inches at various points. Pavement slabs were



Freeing a Joint at Settlement on Sunrise Highway, Long Island, N. Y.

ing in place although there were instances where it was necessary to pump a second time.

In this way, a method of maintenance was made available to the highway officials so that the road could be kept open to traffic, at the same time protecting the concrete from disintegration due to slab failure because of lack of support.

Experience in Pennsylvania.—The second interesting example of problems met in the field was the displacing of the slab on a highway in Pennsylvania due to the settlement of the fill. This pavement was placed on a fill 140 feet high, made up of earth and rock placed with great care. The fill was built in layers and compacted by hauling equipment and rolling. With the weathering and the affect of water some settlement took place in the fill, resulting in lack of support on the sides of the slab, so much so that the pavement was supported in the middle, conformed somewhat to the settlement of the fill, and the longitudinal joint in the middle opened up as much as four inches. 214 yards of earth mixed with cement were required to bring this pavement back into line and to fill the voids under the pavement resulting from embankment settlement. 13 yards of material were pumped through a single hole in the pavement before the slab began to rise.

It is expected that subsequent maintenance will be



Preparing Dynamite to Make Opening Under Slab So Mud Will Start

eight inches thick and the track structure fifteen inches thick.

Holes were drilled through the slab and the track structure and earth, mixed with water and cement, forced under the pavement. Ten yards were pumped into a single hole in the track structure and seven yards in another hole. The whole pavement was raised under traffic, both street car and highway.

An inspection showed that before pumping was started there were voids as much as ten inches deep

under the street car slabs and that the pavement had started to crack in order to conform to the settlement of the fill. In the construction of this fill both stone and earth had been used.

The effect of seepage can be appreciated when it is understood that while pumping into one of these holes, the mud was forced out of the weep hole in the abutment at a point twenty-five feet away from the point at which the mud-jack was working.

Experience in Wisconsin.—Another interesting example of raising a street car track may be mentioned in connection with the work done by the Milwaukee Electric Railway and Light Company on their tracks at Racine, Wis. The track had settled below the pavement and it became desirable to obviate this difficulty. Four hundred feet of track was brought back to line and grade in two days by the drilling of holes through the track structure and the forcing of mud, mixed with cement, under the track. Inspection made four months after the work was done shows the track to be in excellent shape.

On the Washington Boulevard in Baltimore, a span-

gerous curve. When the raising of the curve was undertaken, the outer edge of the curve was four inches below the inner edge, and when completed it was raised to twelve inches above the inner edge, making a total raise of sixteen inches at the high point.

Here again this work was done without disturbing traffic and without the necessity of tearing out the pavement.



Drilling Holes in Highway No. 9 North of New York City

The leveling up of highways over bogs and on unstable foundations has been carried out in many states. By forcing mud under these conditions it is possible to maintain a rigid slab irrespective of the shifting of the foundation. This in no way means that it is undesirable to give full attention to construction methods to eliminate such maintenance, but it does mean that there is no longer reason to leave the slab off of a piece of new fill waiting for that settlement which is expected.

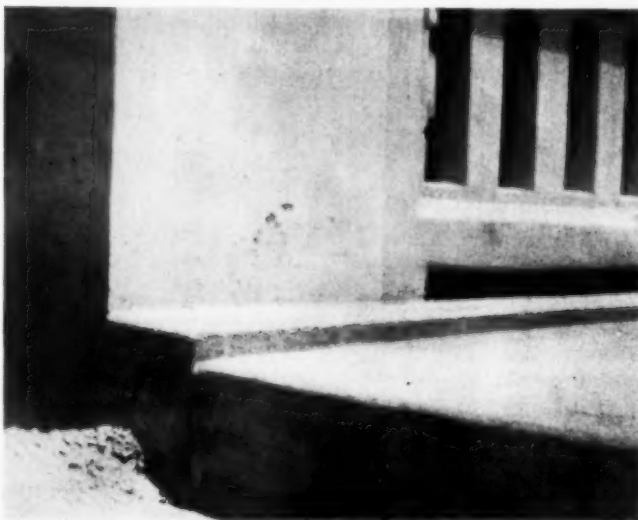


The Shot Exploding; Using an Electric Cap. Where the Slab Is on a Pure Sand Fill and the Mud Will Not Start, an Opening Can Be Blown Out with a Short Piece of Pipe on the End of the Air Hose. Where the Slab Is on a Solid Fill and the Mud Will Not Start, the Slab Can Be Lifted a Little by Attaching the Air Hose to the Slab with a Mud Nozzle and Forcing Air Under It. Mud Can Be Pumped in It at the Next Hole. This Is the Most Common Method

drel filled arch bridge was paved with a concrete pavement. The pavement had settled five inches in places due to the movement of the spandrel filling. Holes were drilled through the slab, mud forced under the slab, and the pavement brought back to the proper elevation.

With the change in highway traffic that must be met, pavements built even five years ago may not be sufficiently wide. At the same time sufficient consideration may not have been given to the question of super-elevating curves to take care of the very rapid traffic.

Experience in Missouri.—The State Highway Department of Missouri has done some excellent work in the super-elevation of curves by the forcing of earth, mixed with water and cement, under the pavement through holes drilled through the pavement. In one instance, 250 cubic yards of earth were forced under the slab to improve the riding qualities of what had been a dan-



Settlement of 2½ In. in Approach Slab to Bridge East of Columbus, Ohio. Raised to Place in 2 Hours

Each project requires an analysis of the problem to be met and overcome. The great variation of subgrade conditions even in a single county or state lead to demand for initiative on the part of the maintenance forces in meeting the conditions.

For instance, a pavement may be laid on a combination earth and stone fill which is sufficiently compact so that there is no possibility to force the particles apart when the mud is forced through the slab, and the

tenacity with which the slab adheres to the material below it, requires development of the technique.

Experience in California.—The State of California found that in one instance it was impossible to get the pavement to raise until they had driven a bar into the grade from the side to tap the hole through the slab. The pressure of the mud against the slab raised it sufficiently so that the mud found an opportunity to force itself between the grade and the slab and give an effect of uniformity over a considerable area.

In New York the problem was met by taking about an inch of a stick of dynamite, dropping it in the hole, tamping it very easily and detonating it, resulting in loosening the subgrade without hurting the pavement.

The usual method is to dig out around the hole underneath the slab with a bar sufficiently to allow the material to take hold. In sandy soil the sand may be blown out with a pipe using the air available from

continues to carry excessively heavy traffic.

These grade settlements are effected, of course, by the conditions, and type of soil, and the depth of fill may not be affected. The sloughing off of the edges of the fill, the movement of water through the fill all have their effects.

The forcing of mud under the slab not only raises the slab but it has the effect of tightening up the fill so that the fill gives better support and more uniform support to the slab after it has been tightened up than previously.

Mt. Vernon Boulevard an Outstanding Example.—An outstanding example of the design of a highway for mud-jack maintenance is to be found in the Mt. Vernon Boulevard from Washington to Mt. Vernon where over certain embankments the Bureau of Public Roads would have hesitated to have placed a rigid type of pavement had it not been for the knowledge that grade underneath the pavement could be kept uniform by the use



Lifting Slab in Illinois. Note Water Tank Trailer at Extreme Left



Tamping Dry Dirt in Holes in Illinois Pavement After Pumping, Common Practice Is to Leave Holes Filled With Mud

the air compressor used for drilling the holes. Another method has been to force air under the slab by connecting the mud nozzle to the air compressor, forcing mud through a second hole as the air raises the slab.

Care must be taken where air is used, and also care must be taken to see that the pump does not pump air so that air will not be trapped below the slab.

Many questions have arisen as to the type of material to be used under the slab and with the great variation of soils it is difficult to make recommendation. Top soil having sufficient loam in it so that it will stay together as a viscous liquid is essential. Perhaps such soil can be found in creek bottoms or back of old mill dams, if not available along the edge of the road.

Certain clay requires a considerable amount of water to handle; it has a much larger shrinkage than has loam and, therefore, is not as desirable. It, however, can be used by the addition of approximately twice as much cement as mixed with loam. Sand should not be used and even sandy clays may prove difficult to handle due to the fact that the water and the cement are separated from the sand by the pressure and the sand soon forms a restriction to the movement of the other materials. With sand, cement and moisture, there is a separation of the three constituent parts which does not occur when loam is used.

Settlement of the slab does not necessarily occur as the grade settles, but generally only upon the failure of the slab due to external forces. End pressure of the slab has a tendency to hold the slab in its original position. The result is that it is not at all uncommon to find settlements of eight to ten inches under a slab that

of the mud-jack. At bridge approaches and over swamps, holes were placed at the time the pavement was built.

The State of Illinois has also made a practice of leaving holes in slabs at bridge approaches so that they may be pumped up from time to time.

The question has been raised as to the desirability of leaving holes in the pavement without filling them again with concrete. It is suggested that water cannot penetrate through the holes when they are filled with a mixture of mud and cement, and further that as the maintenance crews work over the pavement, filling up voids, they may very logically fill these holes with bituminous materials. On the other hand, it is desirable that the material used for filling be of a nature that it can be taken out easily whenever it is necessary to re-pump the highway.

Maintenance is a continuing demand and, therefore, it seems desirable that the highways be designed for continuous maintenance.

Another application and one which will be of material assistance in the maintaining of uniformity of surface not only on county highways but on city streets, is the use of this method for tightening up the backfill over sewer, gas and water trenches crossing the highways. It is not necessary that a sewer trench be an eye sore while settlement is taking place, but rather the slab can be put on almost immediately and as soon as it is hardened sufficiently the material forced under until the grade is uniform. Perhaps it will be necessary to do this two or three times in order to get a uniform support for the pavement.



Opening Snow Bound Highway is Only Control Public Authorities Can Exercise to Prevent Accident and Heartache

By CHARLES L. MOTL

Assistant Maintenance Engineer
Minnesota Highway Department

POOR VISIBILITY

Enhances Chance for Accident

KEEPING the highways open in winter is no longer a problem of unsurmountable dimensions to road authorities who have had experience with it over a period of years and who have had an opportunity to develop personnel and equipment suitable for the work. Road builders have made the problem less difficult through recent years by incorporating in the road design as many construction features as were economically advisable in order to lessen the work and expenditures needed to keep the roads open during the winter. This is particularly true on the highways carrying the greater volumes of traffic of both pleasure and commercial types; and as construction provisions

eased the problem of snow control and removal, the status of highway use has reached the stage where roads can be kept open almost uninterruptedly regardless of snow and storm conditions.

Sight Distance.—With this phase of the difficulty solved, a new factor, the matter of "visibility," has made itself felt more than ever before. In previous years it was usually the case that roads became blocked about the same time that storm conditions became so severe that it was unsafe to travel, on account of poor visibility. But at the present time when road users begin to realize that they are taking very little chance in finding the roads blocked, they will have a greater

urge than ever before to continue traveling, even though the visibility has been reduced to a measure of extremely dangerous proportions.

This brings up the necessity of broadcasting information to the effect that road users must realize when it is safe and when it is not safe to use highways during winter storms. The dangers that may be anticipated are the two major kinds—one is collision between vehicles, and the second the likelihood of the driver missing the highway and bringing upon himself a serious accident. Of these two the one of collision between vehicles is the most serious, since it not only involves the person or persons who are responsible for careless operation, but it involves the dangers that are brought upon others, who, through no fault of their own, are compelled to be out either crossing the highway or attempting to reach a safe haven when caught out unexpectedly.

In the matter of visibility there is absolutely nothing public authorities can do about it except warn road users against taking chances when weather conditions bring about a dangerous situation. Public authorities will hardly be in a position to use their own judgment in stopping traffic, even though such a course might be fully justified. Operating on highways during times of poor visibility is certain to bring about a lot of accidents, the blame for which may often be placed by the unfortunate operators on the condition of the road through some channel or other, and public authorities will be faced with the necessity of overcoming many unfair reports that will be directed toward those in charge of roads during the winter. So far no definite plan has been suggested by anybody to control the matter of how and when highways should be used during periods of severe storm, but the problem nevertheless deserves the most serious attention of those who are responsible for the upkeep of highways during the winter time.

Visibility will affect most seriously that type of road traffic which has an obligation in the way of transporting persons and commodities for hire. Such vehicles are usually required by regulation or contract obligations to carry out their responsibilities under any and all conditions, except those which might be classed as emergencies and just how the emergency will be defined by those in responsible charge of such operations has not yet been clearly worked out.

Acknowledgment.—Credit for this article is due to *The Improvement Bulletin* from which it was taken.

Electric Heating of Pitch in Wood Block Floor Construction

An unusual method of laying wood block floors is described by O. B. Bemis in the October issue of the *General Electric Review*. In this method a thin layer of pitch is spread over the concrete, after which plain non-galvanized wire netting, commonly known as "chicken wire," is laid on the pitch and rolled flat so as not to interfere with the laying of blocks. The blocks are then laid and by passing current through the underlying netting the pitch is melted to such a consistency that it adheres to the block. The blocks are then rolled, power is removed, and the pitch allowed to harden.

Tests showed that $\frac{3}{4}$ -in. nongalvanized netting of 20-gauge wire, 0.031 in. in diameter in strips 3 ft. wide was suitable for general use.

In actual application, using alternating current, a strip of floor containing 6450 sq. ft. was laid, using creosote-dipped blocks 4 in. by 6 in. by $2\frac{1}{2}$ in. The concrete was laid on ground and had been in place about 28 days when the wood floor was started. The floor was approximately 52 ft. by 124 ft. and wire was laid the short way. A jumper was used on one end of the wire and two strips heated at a time, making a total of 312 sq. ft. at one heating. This area of floor could be heated in 15 minutes using 600 amp., or about 10,900 amp. per square inch current density. The power consumed was as follows: 120 volts, 600 amp., 75 kw. as measured by wattmeter. Because of error of instruments used, the volt-ampere consumption did not check actual watts; but the power-factor is evidently very close to unity. In other tests made specifically to determine power-factor, it was found to be very nearly 1.0.

On this particular floor, containing 6450 sq. ft. 375 kw. hr. of energy was used or 522 watt-hr. per square yard. The cost of wire was approximately 9 ct. per square yard and cost of power 0.54 ct. per square yard, making a total cost of 9.54 ct. for power and wire. Connections may be changed in ten minutes and another section made ready to heat. At this rate about 83 sq. yd. could be heated per hour. The equipment used in this particular case was a 100 kw. 2300 to 110/220-volt 60-cycle transformer supplied from a 60-cycle alternator with voltage control. Special clamps to hold cables to wire were used. These clamps consisted of two copper bus bars so arranged that a clamp could be screwed down onto the bars to fasten them to the wire. Almost perfect contact is required because the current density keeps the wire almost at its melting point; and if one section carries more current than another, wires begin to burn off so that in a short time the whole end is ruined. About 18 in. of wire on the end of the strip should be left for fastening the clamps. This allows sufficient space away from pipes and side walls to permit the adjusting of clamps. Columns are taken care of by jumpers clamped to ends of wire, with cable connecting the two jumpers. The wire may be cut the width of the column and folded back, clamps being placed on the ends; but it is much quicker to lay by hand the part section containing the column and not try to heat it electrically. This is also true of corners and incomplete strips.

Precautions must be taken to see that no heavy loads are put on the floor until it is completely cooled, which should be at least 24 hours after heating. Care must also be used in spreading pitch. It is necessary that it be uniform in thickness and that the foundation be as smooth as possible.

Equalize Road Funds

Equalization of road building expenditures was adopted as one of the leading projects of the National Rural Letter Carriers' Association. Mr. Armstrong, past president, stated that the national leaders had planned as their aim the sponsorship of an equalization of expenditures for roads.

"We are for more highways in preference to the building of wider roads where good highways already exist," Mr. Armstrong declared.

He suggested that county associations consult their local highway commissioners, in an effort to push the need for better roads in the rural sections of the many states.

Sand Blasting AS PREPARATION FOR PAINTING

By C. T. HERTZSCH*

SAND blasting surfaces to be painted would be more generally employed if more were known about the simplicity of the apparatus required and its economy.

All that is needed to do sand blasting is:

First, some sort of an air siphon device which will pick up the sand and throw it against the bridge or parts you wish to clean is required.

Second, a sharp, dry, hard sand is required if you wish to make any speed. In the way of equipment other than the tank and piping shown on the illustration, a sufficient amount of air is necessary to maintain a pressure from 50 to 75 lb. (depending on kind of material being sand blasted).

To operate a sand blasting arrangement of the kind shown in the illustration, the compressor should be capable of furnishing a constant supply of air, maintaining the pressure desired.

If you are sand blasting a tank or bridge you will possibly obtain best results by using a 75 lb. air pressure. If you wish to sand blast some thin material, 1/16 in. or less, it is quite important that the pressure be reduced to in the neighborhood of 50 lb., and in some cases less. It is good policy to have the sand strike this thin sheet obliquely instead of at right angles, so as to minimize as much as possible the hammer blow effect of the many small particles of sand striking the surface of the material at high velocity.

I might mention at this time that the selection of a proper sand is quite important as too coarse particles willpeen or stretch a thin sheet so that it will become buckled, and, of course, make a very unsatisfactory surface for painting.

Ordinary river sand, which we have used for many years, is not nearly as economical as a very much more expensive sand which we purchase for this purpose.

Sand blasting works very much faster on hard surfaces such as a scale or old, brittle paint. New paint or gummy material is very difficult to remove with sand blast. In fact, it is very much cheaper to first go over the surface to be blasted with a liquid which will dissolve the new paint or gummy coating and then sand blast the surface to remove scale and what foreign material may remain.

Faster Sand Blasting with Tank Arrangement.—For a long time we used a direct line of air through 3/4 in. hose into the straight side of a cast iron "Y" fitting. Into the angle side of the "Y" fitting, we connected a suction pipe or hose which conveyed sand from a bucket or container through the nozzle in the same manner as one would operate a steam siphon for lifting water. This arrangement was not fast or economical, and in addition to performing work very much slower it used more air.

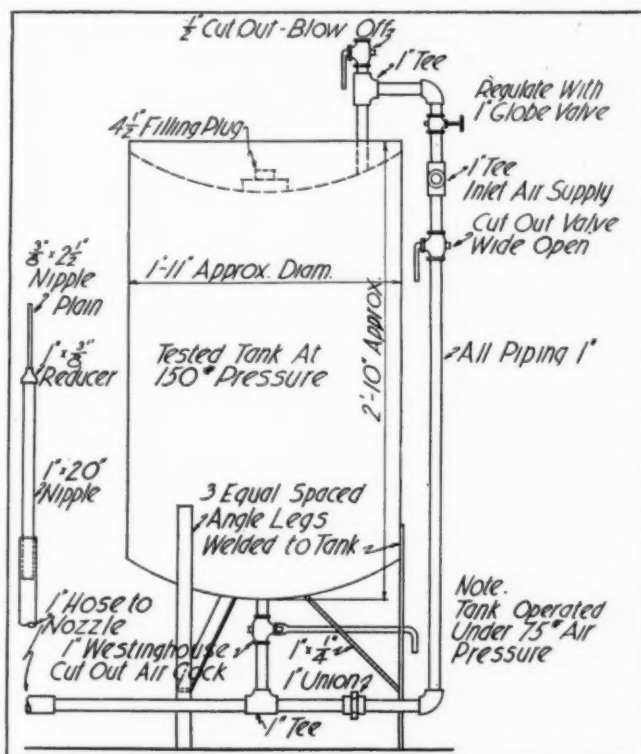
With this old-fashioned method it used to take five men one day to sand blast the outside of a 70 ft. railroad coach. This did not include the trucks nor the roof sheets, as the trucks are not sand blasted and

the roof sheets are always sand blasted and primed on both sides prior to applying to the car.

With the new arrangement, we now sand blast the same type of car, mentioned above, in one-half day and only require the service of three men instead of five. In addition to the tank arrangement being more rapid than the old style way, it also does a very much better job.

Another important feature is that the bridge should be primed immediately after completion of sand blasting operation. You must be careful to prime fully before night falls as the dew will congeal on the surface. Moisture of this sort starts corroding and this is not what you want under the primer.

For a smooth, shiny job all dust from sand blasting operation should first be blown off with air and prior



Sketch of Simple Sand Blasting Apparatus for Cleaning Off Old Paint on Old Cars

to the painting, the surface should be gone over thoroughly with a good stiff dusting brush such as painters ordinarily use.

If grease or similar material comes in contact with sand blasted surface, a good grade of gasoline should be used for washing it. The gasoline must be entirely evaporated before primer is applied.

Equipment Preparations.—For safety sake a reducing valve should be placed in the air line entering sand tank as most outfits carry a pressure on the main higher than 75 lb. There should be placed on the sand tank behind the reducing valve a relief or pop valve to safeguard against any excessive pressure in the event the reducing valve did not function properly.

Test the tanks at 150 lb. hydrostatic pressure or twice the pneumatic pressure they will be required to stand. This should be done periodically if you carry insurance and feel that it is necessary as a safeguard to your workmen.

The air line ahead of where it enters the sand tank should have a *water separator* as it is necessary the air be dry when used for sand blasting.

*Adapted from an address before meeting of Central Electric Railway Master Mechanics' Association by C. T. Hertzsch, District Manager, American Car and Foundry Company.

It is also necessary to have the sand thoroughly dried. For this purpose you can use a stove attachment. Use a return bend type of steam coil at the bottom of sand container having a sloping bottom, the bottom being perforated with holes so that dried sand can fall through.

If working on tanks or equipment and you do not intend using an exhaust fan to remove the dust from sand blasting room, it is quite desirable that you have a room considerably larger than the equipment as to height and width.

Men who are sand blasting should wear some sort of a respirator to prevent inhaling dust, and also wear a dust hood coming down over their shoulders, with a glass aperture in front of their eyes for seeing. This glass should be fixed so that it can be replaced readily as sand blasting soon affects the surface and renders it useless for vision.

If you intend using an exhaust fan the room should be only slightly higher than the equipment and just enough wider to allow the operator to comfortably work on each side. The exhaust fan connection should be at one end of this room and the intake vents at the opposite end. With an arrangement of this sort you will notice the dust from blasting travel rapidly towards the exhaust fan. The men, however, should still wear their respirators and hoods.

In sand blasting an ordinary bridge each man fills his tank several times. If a hard sand is purchased you can use it eight to ten times before it is broken up so fine that its effectiveness for blasting is destroyed.

Each time said is placed in sand blasting tank, it should be screened through an $\frac{1}{8}$ in. mesh screen to remove large particles of rock or foreign articles such as small nuts, washers, etc., which would tend to choke up the sand blast equipment.

One thing that is very necessary when discontinuing the use of sand blast tank is that the $\frac{1}{2}$ in. cut-out cock or blow off valve at the extreme top be opened immediately, cutting off supply of air from your main. This prevents sand being forced into sand blasting hose and filling it up.

For a tank, ordinary air brake reservoirs are employed. It will be noticed the tank has one convex and one concave head, the convex head being used as the bottom which permits the said to flow readily to the outlet pipe. The concave head used as a top serves as a funnel for filling. When loading the tank, it is completely filled.

Acknowledgment.—We reprint this article with some slight changes from *Traction Shop and Roadway Magazine* for the ideas of value it may contain for those who have bridge painting to do.

Colorado Highway Engineering Conference

The Sixth Annual Highway Engineering Conference of Colorado will be held at the University of Colorado in Boulder on January 14-15, 1932.

The conference is sponsored by the Civil Engineering Department and the Extension Division of the University of Colorado with the cooperation of the Bureau of Public Roads and the Highway Departments of the States of New Mexico, Wyoming, and Colorado.

The purpose of the conference is to provide a means whereby the highway engineers of this region may meet to exchange information relative to pertinent highway problems.

The low cost road surface appears to be the only means of correlating the demand for a large mileage of all-weather highways with the limited funds available in a sparsely populated region. The oiled gravel road surface is the contribution of western highway engineers to the solution of this problem and it has provided a satisfactory all-weather road at a low cost.

This year's program will be devoted largely to a discussion of the problems encountered in the construction and maintenance of oiled gravel surfaces and will include the following: Proposed Changes in Road Oil Specifications; Proposed Changes in Oiled Gravel Road Specifications to Secure Satisfactory Bids from Contractors; Desirable Improvements in Subgrade Treatment; Wyoming's Venture in the Field of Oiled Macadam; Necessary Cooperation between Laboratory and Field to Secure Better Construction; Oregon's Standards for Oiled Gravel Roads; and the Use of Light Penetration Oils for Gravel Roads.

In addition to the above, the following subjects will also be discussed: Influence of Low Cost Surfaces on Highway Structures; Depth of Gravel to Meet Varying Soil Conditions; Factors to Be Considered Prior to State Control of County Highways; Traffic Densities That Demand Either Widening or Duplication of Route; and, The Value of Aerial Reconnaissance in Highway Location.

It is expected that the program will be presented by the highway engineers of the Bureau of Public Roads and the highway departments of the States of New Mexico, Wyoming, Kansas, Nebraska, Oregon and Colorado.

The Fourth Annual Convention and Banquet of the Colorado Society of Engineers will be held at the Albany Hotel in Denver on January 16, 1932. All of those in attendance at the Highway Conference are cordially invited to attend the annual meeting of the Colorado Society of Engineers.

Rush Hour Traffic Cut 10 Per Cent by "McClintock Shift"

The rush hour traffic relief plan recently installed in San Francisco has been made the subject of a bulletin issued by the Alfred Russel Erskine Bureau for Street Traffic Research in Harvard University. This bulletin has been published throughout the country. An excerpt follows:

San Francisco has recently accomplished one of the most fundamental and promising improvements in street traffic ever attempted in any city, according to transportation authorities. For the first time a city has succeeded in materially reducing the severity of the morning and afternoon rush hour demands on traffic and transportation facilities.

These movements, commonly known as peak loads, have long been considered as one of the inevitable evils of city life, resulting in inconvenience to thousands of travelers and in great waste in the maintenance of otherwise surplus equipment.

By the application of the so-called "McClintock shift," the similarity in the hours of retail and other types of business has been broken down and the rush hour flow of traffic has been reduced by more than ten per cent. One hundred and fifty business firms participated in the adjustment.

EDITORIALS

No Need of Increased Federal Appropriations, According to Hoover's Committee!

HOOVER'S Committee on Unemployment Relief has reported adversely on increasing the federal appropriations for public works. Its arguments against increases simmers down to five:

First, that a federal bond issue of, say, \$5,000,000,000, would glut the market with bonds, reduce the price of all bonds, make it harder for municipalities and corporations to float new bonds. Here we seem to hear the voice of the banker member of the Committee, Leonard P. Ayres of Cleveland. What new bonds could corporations float that would do more good for the country than an issue that provides work for all the unemployed? If this issue would glut the market as claimed, the \$16,500,000,000 foreign loan issue has gagged it.

Second, that federal appropriations for public works would weaken the sense of responsibility of the states and municipalities. If this is sound argument then nobody should increase his own business activities for fear of "weakening the sense of responsibility" of his business neighbors.

Third, that the building and construction industry would be the sole industry benefited by the proposed enlargement of federal appropriations for public works. This implies that money put into circulation in one field seldom finds its way into other fields. The hod carrier who would be given a job would of course see to it that none of his wages reached the corner grocery or the neighboring clothing store or the "filling station."

Fourth, that a general increase in federal expenditures would help many districts that are not in need of such aid. It would have been interesting had these Committeemen been cross-examined a bit on this point: Please specify, Mr. Committeeman, what districts in America are so prosperous that no further expenditures for public works are needed to enhance their well being?

Fifth, it would take many years to pay off a bond issue of, say, \$5,000,000,000, and the interest on the bonds would be burdensome. Yes, the interest would be about \$200,000,000 a year. It is conservatively estimated that the present annual income of the American people is about \$20,000,000,000 below normal, or 100 times the annual interest on a \$5,000,000,000 bond issue. Therefore, gentlemen of the Committee, why didn't you look on the other side of the balance sheet?

The fact is that this Committee is really a special pleader against federal assistance in the revival of business activity. Its arguments are entirely one-sided, as is perhaps best shown by its opposition to any increase in the present annual \$125,000,000 federal road appropriation. Speaking of this the Committee said: "In considering the relation of these (federal road) expenditures to present unemployment, the real question is not the need of more money but rather the expenditure of money at places where emergency may exist." Merciful cats—and Committeemen—tell us where an emergency does not exist!

"Good Roads" Absorbed by "Roads and Streets"

EXACTLY 40 years ago the first highway periodical was launched by the late E. L. Powers. Its name was "Good Roads."

In January, 1892, America was a country of almost universally bad roads. New Jersey enacted the first "state-aid law" in that year. New York did not adopt "state-aid" till 1896, and then the Empire State appropriated only \$50,000. Ford was producing small motor cars in a small way, but at a price beyond the purse of all but the well-to-do. Selden had driven a gasoline buggy around the streets of Rochester, N. Y., 6 years earlier, but had stored it in his barn, and was purposely keeping his patent "slumbering."

"Good Roads" had come as a magazine, but good roads were still merely a dream in nearly all our states. Indeed they had scarcely reached the dream stage in more than a dozen states. It took foresight and not a little courage to launch a highway magazine 40 years ago.

Yet good roads had been built by the Romans before the birth of Christ—good but expensive roads. In America a few good toll roads had been constructed as early as 1800, but the advent of the "iron horse" in America in 1829 had served to halt the progress of road building by turning capital to railroads. By 1892, another "iron horse" had arrived, one whose fodder was not wood or coal but gasoline. This second "iron horse" was destined to revive the road building that the first iron-horse had halted. But the revival was to be slow until new laws had spread the burden of highway costs more equitably.

Eight years later, in 1900, George Selden told the writer his plans for the future. He had just been granted a basic patent on a road-vehicle propelled by an internal combustion engine. He purposed making his royalty so low—1 per cent of the selling price—that it would be cheaper to pay than to fight. Ford, however, chose to fight. Finally he won, but not before Selden had garnered \$3,000,000 in royalties from other manufacturers of automobiles. Selden candidly admitted that his was a dog-in-the-manger policy, so it was well that his patent was not sustained by the Supreme Court.

To the readers of "Good Roads" we extend a cordial welcome.

H. P. Gillette



Trend of Highway Matters

ON Friday, December 11th, the report of Committee on Highway Finance of the Highway Research Board by Thomas MacDonald, Chief of the Federal Bureau of Public Roads, was interesting and instructive. While the thoughts expressed were not new to leaders in the highway field they did crystallize thoughts

which are taking shape around the country and showed definite trends in methods of financing.

Discussions which followed also served to confirm Mr. MacDonald's conclusions. Briefly, some of the high points in this address and discussions were that Wisconsin, the state in which an extensive survey had been made and which cost about twenty-five or thirty thousand dollars, shows that a reorganization of administrative policies and personnel is necessary. This applies also to all states, Mr. MacDonald pointed out. This reorganization would include a doing away with all township and town organizations as concerned road building or other public works, and the county should be the smallest road building unit. In some states several counties should be combined into one administrative unit, particularly where counties may be poor. It was pointed out that the time is ripe for reorganizing and cutting cost in administration, as well as a reduction of uneconomic methods.

This doing away with township organizations would cut costs and would result in greater efficiency and is highly desirable. Examples of how these policies are working out are already to be found. In Michigan, for example, the state is taking over the townships and many of the secondary roads at such a rate that they will all be taken over within five years. Iowa has already done away with the township divisions, about two years ago with satisfactory results.

It was pointed out that property taxes are higher where the township units or any other small units administer highway funds. On the other hand in Ohio some forty-two hundred townships have combined into a very effective organization as a political unit to further the interests of the townships. It has resulted in uneconomic conditions with large administrative forces and it proved to be very uneconomic in that state.

Another thought worthy of note is the demand by cities for a portion of the gas taxes. A survey in Wisconsin indicated that the cities were probably entitled to it because of the large percentage of the total which they pay. It is probable that the best way of meeting this demand is to extend the state systems through the towns and cities at the expense of the state and that further expansions on feeders to these trunk lines be constructed by the state.

The purpose, of course, is to maintain and retain the state highway departments and give them something to do after they have completed the trunk systems, and at the same time satisfy the demands made by the cities.

From the foregoing it will be seen that things are in a state of flux as regards administration forces in which state highway departments are now in some instances taking over many miles of secondary roads, or in which counties are absorbing townships and in which there is a probability that state highway departments will do considerable construction through towns and cities.

This looks like a healthy condition and should be encouraged in the press and elsewhere, because state highway administrations in most instances are the most efficient and effective highway organizations in the country and they should be encouraged, maintained, and continued in a consulting capacity for all the political subdivisions of the states, as well as to handle state trunk highway construction.

Another topic which is timely and should be given consideration is the diversion of gas tax. Probably the time is at hand when all those interested in highway work must unite for promoting worthwhile policies; they must forget their petty jealousies. Some organ-

ization or group, or leader, or leaders must very shortly take this matter in hand. As we suggested in the August issue of *ROADS AND STREETS*, the organization or commission to do this work might well be a super-association of factors interested in highway progress.

The highway industry is up against a battle to keep road and street improvement work from showing a detrimental decline during the next decade. A super-association is needed to provide promotional matter for the daily press and popular consumption in order to keep highway expenditures on a par from year to year during this tightening period.



Deal With the Advertiser

NOW, more than heretofore, buyers of road building equipment are more discriminating; more investigative; and more cautious. This inquisitive attitude on the part of highway construction equipment purchasing power is bringing forth a condition that manufacturers can not afford to ignore. The program for the coming season is studied and planned to considerable detail. Methods of construction or maintenance are compared more rigorously than formerly. This involves comparison of equipment performances; costs and service.

As a reader of this magazine, you depend upon us to separate the propagandized publicity from genuinely instructive, authoritative, educational articles. That is our duty; a responsibility as subscribers to the policies of *ROADS AND STREETS* that you have placed upon us. In reading the magazine, you not only read the editorial matter, but also the advertising. Correct advertising, likewise, is educational, informative, and instructive. You are the economic buying or recommending power in the highway industry. It is to your advantage to deal with advertisers! Why? Because they are the entities that make it possible for us, or any other magazine, to keep you fully informed on developments and trends in the industry. Directly through the editorial columns with biased publicity? No! But because we sell blank white space to them so as to get money with which to publish this magazine. The editorial staff of *ROADS AND STREETS* are professional engineers first, editors next. The staff is imbued with the professional idea and consequently work for the economic interests of the industry as a whole. You read and act upon what we publish because you recognize the authority or high ethical standard of the magazine.

Because of this fact, manufacturers of highway construction and maintenance equipment and materials owe you the responsibility of placing information about their products before you. Furthermore, because of the closer analysis of your budgets you are more discriminatory in the purchase of your equipment. These conditions then, place a double responsibility on manufacturers' and advertisers' shoulders. But you do not escape responsibility entirely because you owe it to them to purchase advertised equipment.

In a business way, from the viewpoint of the manufacturer, "It pays to advertise"; from your viewpoint, "It pays to deal with the advertiser." That is cooperation, and cooperation is what is required to drag us out of the present economic condition.

V. J. Brown.

County and Township Roads

A Section Devoted to the Interests of Those Responsible for Secondary Road Improvement

By GEO. E. MARTIN

Consulting Engineer, The Barrett Company

ELIMINATING CRITICISM

OF

SURFACE TREATMENT OPERATIONS



Distributing Cover with Mechanical Spreader

SURFACE treating operations probably cause more bitter complaint on the part of the motorist than any other type of highway maintenance. Much of this is justified, but the almost universal tendency to blame the bituminous material is unreasonable. These operations are a necessary part of practically all highway programs so that anything which can be done to accomplish the results and be less objectionable to traffic will be quite worth while.

The extensive construction of low cost road surfaces in the past few years has resulted in greatly increased mileage of mudless roads but most communities are not satisfied with that. Plain stone and gravel roads will lift the traveler out of the mud but when there is any appreciable amount of traffic, maintaining them with the addition of more stone or gravel is too expensive for the type of road service rendered. The dust also becomes decidedly objectionable, and often the supply of easily obtainable gravel and stone is seriously depleted.

The next logical step is to apply something to the surface of the road which will bind it together and form a crust which will not be torn off by automobile wheels and blown away. Some sort of bituminous material is very frequently used for this purpose in the United States and Canada, as well as abroad. The bituminous material, being exposed to the weather and to the action of traffic, becomes less effective in time and must be renewed periodically. These renewals serve the same purpose as coats of paint on buildings. They are really

road preservatives and a very necessary part of the highway program if we are to continue to enjoy extensive traffic facilities. Surface treating operations of this sort may be required every year in some cases while in others they may be needed only every two or more years.

Like many other vital and necessary things, these surface treating operations have certain unpleasant features. They may be decidedly objectionable to motorists who either wilfully or unintentionally get on a road while it is being treated. While the period when they are in this condition is relatively short, much can be done to make even this short time less of a trial to the motor car driver. Proper selections of bituminous material, correct amounts and methods of application, satisfactory type and amount of covering material will all help to reduce the unsatisfactory aspects of surface treatment work. Many successful surface treating methods involving a minimum of inconvenience to traffic have been worked out in various localities.

The selection of the proper grade of bituminous material will help. Best results are obtained on original treatments with materials applied cold. In order to permit time for them to penetrate the road surface and bind it together they must be somewhat slow drying. These types give the most trouble and the road should be closed while they are being applied. This is a matter of only a short time and motorists should respect the detour signs for surface treatment operations as well as for paving operations. At the most it is only a few

days while a paving job may close a route for months at a time.

The State of Connecticut successfully treats many miles of gravel roads using cold tar. It is applied in small quantities, usually not more than $1/6$ or $1/8$ gallon per square yard on re-treatments and immediately covered with coarse sand or fine gravel. Ample cover is used so that traffic will not pick up the tar. The cover is dragged with a sled drag which accomplishes two things: the road surface is made much smoother since the drag cuts off the high spots and fills in the low ones; and the tar and covering material is thoroughly mixed so that the drying time is greatly reduced. Some of the other New England states accomplish the same result by the use of a brush drag, which is essentially a bundle of brush dragged behind a truck. This stirs up the tar and cover and hastens the drying action.

On re-treatments much can be accomplished by the use of heavier bituminous materials which must be heated before application. Since such tars are liquefied by heat they set up or solidify as soon as they cool. This action is very rapid. Such materials should be covered thoroughly with slag or stone chips or pea gravel. The covering material should be rolled into the road surface. Treatments of this sort can be opened to traffic as soon as finished and there should be no future inconvenience to traffic. They have a further advantage in that they usually last for more than one year without retreatment.

Organizations treating many miles of macadam roads with tar every year have reduced complaints from motorists by treating only one-half of the road width at one time. They allow several days for the bitumen to cure on one side of the road before treating the other side, thus always providing at all times part of the road with no fresh bituminous material on it.

There has been a tendency on the part of many road officials to use too heavy applications of bituminous material. Sometimes as much as a half gallon per square yard has been used where a quarter gallon or less would have done the job. It is the excess material which causes trouble. Too little will do less harm than too much.

The amount and quality of the covering material will do much to make fresh treatments safe and easy to drive over. Here the rule given above for bituminous material should be reversed. If any error is made it should be on the side of more cover rather than less. The excess will be brushed to the side of the road and will not be entirely wasted but assist in strengthening the road shoulders.

These various methods for carrying on surface treating operations with the least amount of inconvenience to the traveling public are listed below.

- Selection of proper type of bituminous material.
- Correct amount of bituminous material per sq. yd.
- Adequate covering material of the proper quality.
- Planning time of application to avoid maximum traffic.



Various Methods of Dragging or Spreading Cover

The use of the drag after covering to hasten the drying action where cold materials are used.

Treatment of half of the road at a time.

Adequate detours where necessary.

All of these operations have been successfully used and their use will make it possible to have many miles of safe, dustless, low cost roads at a minimum of inconvenience to the motorist. The car driver can do his part by using the detours when provided and by reducing his speed when it is necessary to drive over freshly treated roads. Co-operation on the part of all concerned will result in better highway service for everyone.

Canadian Engineer Suggests Straight Blades

In Huron County, T. R. Patterson, the county engineer, has developed a mouldboard for attachment to power graders. The mouldboard was developed to permit the convenient use of flat edges on power graders, used for maintenance work. The sharpened edge of the curved blade is of no advantage on such work, as, after the first mile of operation, it becomes dull, and the grinding effect of the gravel is so great that an edge is sometimes worn entirely out in two days. In addition, the changing of the edge occupies about an hour of the operator's time, and delays the work to that extent. The curved mouldboard has no advantages over the flat one, and the advantages of the above outfit are as follows:

1. Permits the use of flat edges which may be secured from the mills as plates for less than .03 cents per lb., and by having the holes cut in a local shop, the cost of a ½-in. by 12-in. edge will be about .75 cents per foot, as compared to a cost of \$1.40 per foot for a ½-in. by 6-in. curved edge.

2. Edge may be readjusted in from 5 to 10 minutes, as compared to 1 hour.

3. Waste of metal in wornout edge is reduced from 38 per cent to 18 per cent.

The saving in cost in the operation of power graders, by this means, will be \$20 per week, more or less.

The extension edge shown is another idea developed. To detach, it or place it on opposite end, is but a simple operation.

Acknowledgment.—From the Canadian Engineer.

Why Counties Should Have Larger Highway Income

A note or two on "Why and On What Basis Counties Should Receive Larger Proportion of Total Highway Income?"

Some of the rougher sections of the counties of Missouri since the days of better roads and automobiles have become almost depopulated and are a burden rather than a resource to the public.

One community includes what is known as "The Lost Fourteen Hundred Acres"—a rather rough tract but consisted of a number of small farms owned by good law-abiding citizens twenty years back. The young folks not willing to live where they could not get out and in with a car moved out to more accessible places. The old folks allowed the brush to take the farms and the roads to get worse and the tracts drifted into the hands of traders. Now it is a breeding and hiding place for wolves which prey on the farmers for miles around.

These communities will never build a road without outside help and with a road farmers will be induced to stay on the farms.

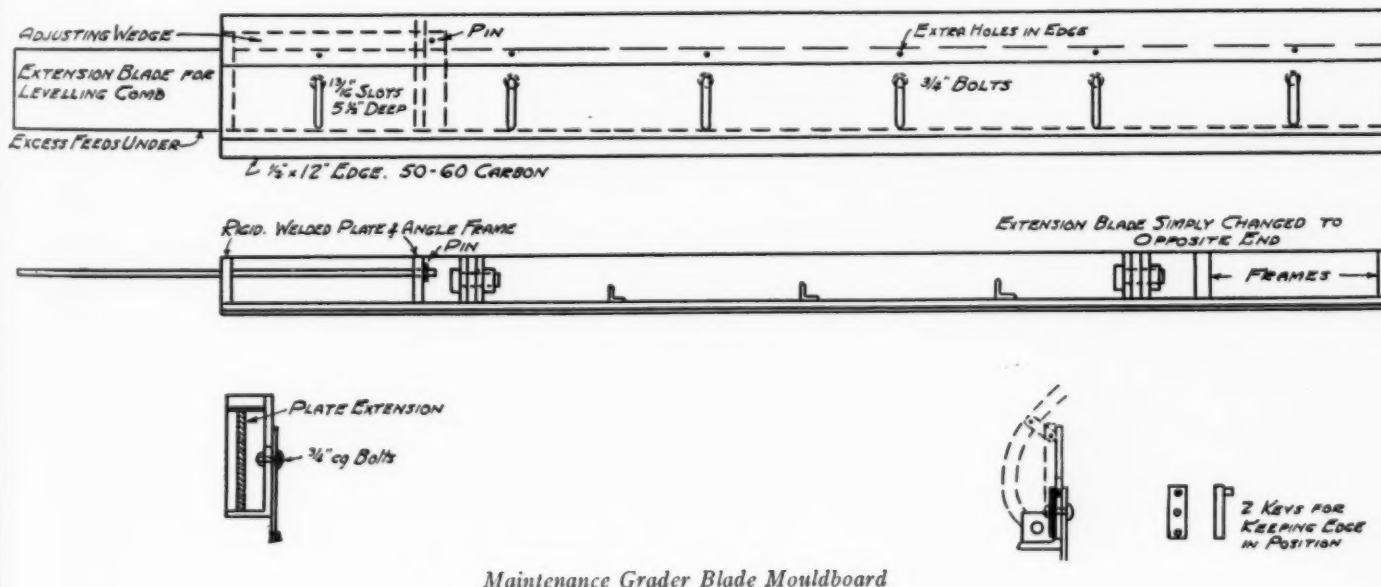
A large part of the man power of the cities comes from the farm and it is being realized that it is the interest of the public to educate the farm boys and girls and good roads are necessary to make the school accessible to the farm boy.—*W. P. Divers, Surveyor of Callaway, Mo.*

Ditches Cause of Trouble

Libel suits should be decided in favor of free criticism and discussion where possible, the Wisconsin Supreme Court declared today in ruling against Henry J. Grell's libel suit against H. D. Hoard and Laus, publishers of the Jefferson County Union.

Grell is county highway commissioner, and the paper has been carrying on a systematic campaign against roadside ditches as built in the county and elsewhere.

The paper contended the roadside ditches were death traps and referred to the highway commissioner as a "killer." The Supreme Court held that the paper did not intend to ridicule Grell, but was attempting to arouse the public against the dangerous ditches. The court then held that in case of doubt the question of libel should be resolved in favor of free criticism and discussion.—*Chicago Tribune Press Service.*



Maintenance Grader Blade Mouldboard

BEFORE



Logan County, Illinois, Was Not Satisfied With the Drainage Condition of This Road or the Surfacing for the Traffic



Blue Mound Highway—a County Super-Highway in Milwaukee and Waukesha Counties, Wisconsin, Was Entirely Too Narrow to Accommodate Sunday Traffic

AFTER



Before Graveling the Surface the County Supervisors Were Quite Pleased With This Excellent Grading Job



In Preparing for Future Traffic on Blue Mound Highway the Center Parkway Was Left Open Until Required

FROM THE COUNTY VIEW POINT

Results of Questionnaire to County Engineers and Superintendents

THERE being no agency to whom to refer to get digest of secondary road laws, ROADS AND STREETS sent out a questionnaire to all counties requesting information which has been summarized below. We do not guarantee the accuracy of the replies only to state that they are replies by county engineers

and superintendents to the questions asked. We simply collated the questions with their answers and believe they give a general idea of how gas tax and motor vehicle license funds are pro-rated among the counties reporting.

GAS TAX AND MOTOR VEHICLE LICENSE FEES APPORTIONMENT

State	Does County Get Portion of Gas Tax Income for County Road Work?	If So, On What Basis?	Does County Get Portion of Motor Vehicle Income for County Road Work?	If So, On What Basis?
Alabama	Yes	1/67 of 2 ct. tax over entire state	No	
Arizona	Yes	2/5 to counties; state balance	No	
California	Yes	1/2 ct. per gallon and 1 ct. according to auto registration	Yes	1/2 of net receipts according to auto registration in each county
Colorado	Yes	According to state road mileage	Yes	About half
Delaware	No		No	
Georgia	Yes	Per mile of state highway	No	
Illinois	Yes	1 ct. goes to counties according to proportion of county motor license to total motor license	No	
Indiana	Yes	3/4 ct. to county, 1/4 ct. to towns and cities in county	No	
Iowa	Yes	Ratio area of county to area of state, approximately 1 1/2 cts. on each 3 cts.	No	
Kansas	Yes	Divided to 165 counties as follows; 60% equally, 40% according to assessed valuations. This amount is divided again 50% with townships	No	
Kentucky	No		Yes	50% of truck license.
Louisiana	No		No	
Massachusetts	No	State about equal to amount appropriated by county	No	
Michigan	Yes	Counties receive about 1/2 of total vehicle fees collected; 1/8 of county share distributed according to amount collected in each county and 1/8 distributed equally to all counties; see State Law—Sec. 19, Act 150 P. A. 1927, Sec. 24, Act 1, P. A. 1925, about 1/83 of total income to each county	Yes	See State Laws, Sec. 19, Act 150 P. A. 1927, Sec. 24, Act 1, P. A. 1925.
Minnesota	Yes	Pro-rated among counties; not less than 3/4 of 1% and not more than 3% to a county out of state collection of gas tax	No	
Mississippi	Yes	2 cts. per gal.	Yes	All
Missouri	No		No	
Montana	No		Yes	All registered in county less cost of manufacturing and mailing plates
Nebraska	Yes	For graveling, 1 ct. per gal. divided 1/2 according to post roads, 1/2 according to area, 1/2 by population	Yes	35% of auto tax distributed
Nevada	No		No	
New Jersey	Yes	Allotted to some counties by state highway dept. on area-mileage-population basis	Yes	Allotted by State Highway Commission. On basis of area, mileage, population
New York	Yes	Pro-rated on mileage	Yes	25%
North Dakota	Yes	Variable, about 1/4 of state tax	Yes	1/2 after deduction of expenses distributed
Ohio	Yes	Approx. 17%; equally divided to each county	Yes	Approx. 50% of amt. collected in each county

State	Does County Get Portion of Gas Tax Income for County Road Work?	If So, On What Basis?	Does County Get Portion of Motor Vehicle Income for County Road Work?	If So, On What Basis?
Oklahoma	Yes	1 ct. per gallon of 4 ct. tax	Yes	60% according to population and area
Oregon	No		Yes	25% goes to payment of bonds and interest.
Pennsylvania	Yes	1/2 ct. of 3 ct. gas tax	No	
South Carolina	Yes	1 ct. of gas tax to county	No	
South Dakota	No		Yes	78% income
Tennessee	Yes	1 ct. area and population, 1 ct. equally among the counties	Yes	All of county license plates
Texas	No		Yes	All up to fixed maximum which varies from \$50,000 to \$175,000
Utah	No		No	
Virginia	Yes	State tax 5 cts.; county gets 1 1/2%; the 1 1/2% divided equally in 3 districts	No	
Washington	Yes	1 ct. of 5 ct. tax returned to counties for lateral highways	Yes	1 1/2 mills on assessed valuation of county
West Virginia	No		No	
Wisconsin	Yes	\$3,000,000 allotted to counties; divided to counties on basis of 60% road mileage, 40% auto registration	Yes	20% allotted 60% road mileage —40% auto registration
Wyoming	Yes	1 ct. proportioned to counties according to motor registration	No	

Counties, generally, have definite county road systems with definitely scheduled improvement programs. However, the condition is not as healthy as should be expected. Very few counties have made traffic counts or surveys on county road systems. Since the trend of

highway planning is toward basing improvements upon a traffic survey coupled with a knowledge of local conditions, it seems advisable that counties make these surveys and tie them into the economics of their improvement plans.

COUNTY ROAD IMPROVEMENT AND PLANNING DATA

State, County or Parish	Has County Adopted a Definite County Road System?	Has County Adopted a Definite County Road System Improvement Plan?	Has County Made Traffic Survey on a County Road in Past Three Years?
Alabama, Mobile	Yes	Yes	Yes
Monroe	Yes	Yes	No
Arizona, Pima	Yes	Yes	Yes
California, Napa	Yes	Yes	Yes
San Joaquin	Yes	No	Yes
Siskiyou	No	No	No
Colorado, Costilla	No	No	No
La Plata	No	No	No
Lincoln	Yes	Yes	No
Delaware, Kent	Informally	Yes	Yes
Georgia, Calhoun	Yes	Yes	No
Jefferson	No	No	No
Jones	No	No	No
Illinois, Brown	Yes	Yes	No
Bureau	Yes	No	Yes
Greene	Yes	Yes	Yes
Ogle	Yes	Yes	No
Peoria	Yes	Yes	No
White	Yes	Yes	No
Woodford	Yes	Yes	No
Indiana, Blackford	Yes	No	No
Davies	Yes	No	No
Howard	Yes	Yes	On main roads
La Grange	No	No	On main roads
Pike	Yes	No	No
Warren	Yes	No	No
Wells	Yes	No	No
Iowa, Adams	Yes	No	No
Buena Vista	Yes	Yes	No
Clinton	Yes	Yes	No
Dallas	Yes	Yes	No
Dickinson	Yes	Adopts yearly plan annually	No
Dubuque	Yes	Yes	No
Floyd	Yes	Yes	No
Franklin	Yes	Yes	No
Jackson	Yes	Not entirely	No
Johnson	Yes	Yes	Yes
Monroe	Yes	Tentative plan	No
Page	Yes	Yes	Yes
Pottawattamie	Yes	Yes	No
Sioux	Yes	Yes	No
Tama	Yes	Yes	Yes

State, County or Parish	Has County Adopted a Definite County Road System?	Has County Adopted a Definite County Road System Improvement Plan?	Has County Made Traf- fic Survey on a County Road in Past Three Years?
Kansas, Barton	Yes	Yes	No
Chase	Yes	Yes	No
Cherokee	Yes	Yes	No
Crawford	Yes	Yes	No
Decatur	Yes	Yes	No
Elk	Yes	Yes	Yes
Hamilton	Yes	Yes	No
Jefferson	No	No	No
Leavenworth	No	No	No
Logan	Yes	Yes	No
Marion	Yes	Yes	No
McPherson	Yes	Yes	No
Meade	Yes	No	No
Mitchell	Yes	Yes	No
Nemaka	Yes	No	Yes
Reno	Yes	No	No
Riley	Yes	No	Yes
Saline	Yes	Yes	No
Trego	Yes	Yes	No
Wichita	In part	Partially	No
Wilson	Yes	No	Yes
Kentucky, Anderson	No	No	No
Edmondson	No	No	No
Henry	Yes	No	Yes
Mason	Yes	Yes	No
Nelson	Yes	No	No
Pike	Yes	Yes	No
Louisiana, Bossier	Yes	Yes	None
Caddo	Yes	Yes	No
Lincoln	Yes	No	No
Morehouse	Yes	Yes	No
Sabine	No	No	No
Massachusetts, Essex	No	No	No
Norfolk	No	No	No
Worcester	With state	Yes with state	No
Michigan, Gogebic	Yes	Yes	Yes
Lapeer	Yes	No	No
Luce	Yes	Yes	Yes
Manistee	Yes	Tentatively	No
Menominee	Yes	Yes	Yes
St. Joseph	Yes	Yes	Yes
Washtenaw	Yes	Yes	Yes
Wexford	Yes	Yes	No
Minnesota, Aitkin	Yes	Yes	No
Blue Earth	Yes	Yes	Yes
Jackson	Yes	Yes	No
Koochining	Yes	Yes	Yes
Olmstead	Yes	Yes	No
Rock	Yes	Yes	No
Todd	Yes	Yes	No
Wabasha	Yes	Yes	No
Waseca	Yes	No	No
Watsonwan	Yes	Yes	No
Yellow Medicine	Yes	Yes	Yes
Mississippi, Lowndes	No	No	No
Webster	Yes	Yes	No
Missouri, Clinton	No	No	No
Dade	No	No	No
Dallas	No	No	State has
Franklin	Yes	Yes	No
Jasper	No	No	No
Montgomery	No	No	No
Monroe		General	No
Ozark	No	No	No
Polk		No	No
Putnam	No	No	No
Ralls	No	No	No
Montana, Beaverhead	No	No	No
Chouteau	Yes	Yes	Expect to this year
Glacier	Yes	No	No
Liberty	No	Yes	No
Ravalli	Yes	Yes	No
Sheridan	No	No	No
Nebraska, Fillmore	Yes	Yes	No
Saunders	Yes	No	No
Nevada, Elko	Yes	Yes	No
New Jersey, Gloucester	Yes	Partially	Yes
Salem	Yes	Yes	No
Sussex	Yes	No	No
New York, Cattaraugus	Yes	Yes	No
Madison	Yes	Yes	Yes

State, County or Parish	Has County Adopted a Definite County Road System?	Has County Adopted a Definite County Road System Improvement Plan?	Has County Made Traf- fic Survey on a County Road in Past Three Years?
Schuyler	Yes	Yes	Yes
Washington	Yes	Yes	Yes
Wyoming	Yes	Yes	No
North Dakota, Barnes.....	Yes	Yes	No
Eddy	Yes	No	No
McLean	Yes	No	No
William	Yes	Yes	No
Ohio, Adams	No	No	Yes
Clark	Yes	Yes	No
Fairfield	No	No	No
Greene	Yes	Yes	No
Huron	Yes	Yes	No
Seneca	Yes	Yes	No
Washington	Yes	Yes	No
Oklahoma, Bryan	Yes	Yes	No
Cleveland	No	No	No
Kiowa	Yes	Partially	No
Lincoln	Yes	No	No
Okmulgee	Yes	Yes	No
Pittsburg	Yes	Yes	No
Oregon, Lincoln	Yes	Limited	No
South Carolina, Williamsburg.....	Yes	Yes	Yes
South Dakota, Beadle.....	Yes	No	No
McCook	Yes	Yes	No
Moody	Yes	Yes	No
Spink	Yes	Yes	No
Tennessee, Dyer	Yes	Yes	No
Humphreys	Yes	Yes	No
Texas, Childress	No	No	No
Culberson	No	No	No
Dallas	Yes	Yes	No
El Paso	Yes	Yes	Yes
Harris	Yes	No	Yes
Jones	No	Yes	No
Matagorda	Yes	Yes	No
Motley	No	No	Yes
Rusk	No	Partially	Yes
Tyler	Yes	Yes	Yes
Wharton	Yes	Yes	No
Wise	No	No	No
Utah, Utah	No	No	No
Virginia, Albemarle	Yes	Yes	No
Washington, Benton	Yes	Yes	No
Clark	Yes	Yes	No
Ferry	Yes	No	No
Gray's Harbor	Yes	In part, yes	No
Klickitat	No	No	No
Lincoln	Only for 10 years	No	No
Okanogan	Yes	Yes	No
Spokane	Yes	Yes	Yes
Whitman	Yes	Yes	Yes
West Virginia, Roane.....	Yes	Yes	No
Harrison	No	No	No
Ohio	Yes	Partly	Yes
Wood	No	Yes	No
Wisconsin, Burnett	No	No	No
Lincoln	Yes	No	Yes
Marquette	Yes	Yes	No
Milwaukee	Yes	No	Yes
Polk	Yes	Yes	No
Vernon	Yes	Yes	Yes
Wyoming, Goshen	Yes	Yes	No
Sweetwater	Yes	No	No

Results of Questionnaires to Engineers and Superintendents in Six States

DURING the latter part of 1931 ROADS AND STREETS questioned county engineers and superintendents in all of the counties of the six states as listed below. These states were picked at random with the intention of covering all later. However, it was not convenient to continue the questionnaire so we present what data were collected for the value of the many thoughts contained therein.

Answers to the financial questions indicate that engineers do not thoroughly understand their state laws. This should be one of the first duties of a county engineer or superintendent. He should be thoroughly versed in the legal limitations governing county road work.

The names of the counties were omitted here but each set of answers is from identical counties.

HAS YOUR COUNTY ADOPTED ANY IMPROVEMENT SCHEDULE? IF SO, PLEASE EXPLAIN**ALABAMA**

No.

Our problem for the near future is the proper maintenance of our already built roads.

ARIZONA

We have adopted an improvement schedule which is not very complete, but it is sufficiently so for the present stage of our development. We are making dirt roads twenty-four feet in width, said roads being in the country districts where there is not much traffic. In the suburbs of Tucson, but outside of the city limits for a distance of from four to six miles out of town, we are putting in twenty foot oiled roads, using asphalt oil of 60-65 per cent grade, and both crushed material and river gravel, with specifications calling for better than twenty per cent metal, and from eight to fifteen per cent minus 200 mesh. On these oiled highways we are building four-foot shoulders which are well made. At our river crossings in the country on the roads which are not main highways we are building pile bridges. For this work we are using creosoted timber throughout.

Yes. Continued effort to bring all roads up to standard with alinements, and proper structures.

FLORIDA

No.

No.

IOWA

1 year only.

Yes. In 1930 a three year construction program for improvement of local county roads was adopted. Very little work was done during 1930. 1931 will complete approximately 50 per cent of this program. In making out the tax budget for 1932, the Board disregarded the law and this program by cutting levies for road work until no money will be available for construction work. Therefore, we have no definite plan for 1932, or thereafter.

Only for construction each year.

We have complied with the law and have adopted a definite improvement program. It includes the construction of twelve concrete box culverts and cutting 0.8 miles of road to permanent grade. An addition to this program is the construction of a 120 foot steel truss which is being built as an emergency measure. The trunk road program includes the construction of eleven steel bridges and earth approaches. This bridge program will cover every steel job on the trunk roads most apt to be put to permanent grade in the next few years.

Each county proceeds with the improvement of the county trunk system as fast as funds will permit. This work is usually carried on according to a definite program laid out several years in advance.

Yes.

Annual program made in February each year. Thirty-five per cent of construction funds to local roads. Sixty-five per cent to trunk roads.

Hand-to-mouth programs.

We adopt a construction program for available funds each year.

Yes.

In 1926 Johnson County adopted a 96 mile grading and graveling program on our county trunk system, this program being financed by current revenue and a bond issue of \$603,864.00. This program will be completed in 1932. In 1930 under a new law Johnson County adopt-

ed a three year program of grading and surfacing 115 miles of county trunk and local county roads to be financed entirely out of current revenue.

Adopts program for each year.

Yes. Three year road program as required by the Bergman secondary road law, Senate File 169, 43d G. A.

Yes.

Yes, for one year.

Yes.

MONTANA

No.

Yes—standard 24 ft. road base on highways and 18 ft. to 20 ft. on new bridges.

No.

No.

NEW MEXICO

Not that I know of.

No.

UNDER WHAT CONDITIONS MAY COUNTIES ISSUE HIGHWAY BONDS AND HOW ARE THEY PAID?**ALABAMA**

Limited by taxable property assessment.

Up to the constitutional limits for counties in the state.

ARIZONA

By vote of people at special election.

By vote and direct levy.

FLORIDA

This county issued \$1,250,000 bonds in 1927 then laid out and constructed 110 miles of hard roads. No more bonds for a good while.

By majority vote of the free-holders. Paid by state gasoline tax and by ad valorem tax on property.

IOWA

Sixty per cent of special election.

By a 60 per cent vote of the people of the county. To be paid by taxation.

By majority vote to be retired by issuing anticipation certificates based on the estimated revenues for the year and by current tax levies and the county's share of bridge refunds from the state and the county's share of gas tax.

Bonds must be voted.

Counties having a population of more than 70,000 may issue bonds for the improvement of county roads, and may levy taxes in an amount sufficient to pay interest and principal thereon when authorized to do so by a vote of the people.

Law provides for no secondary road bonds.

Statutory limits on bonded indebtedness.

For paving of roads by vote of taxpayers.

See enclosed secondary road law.

Counties in Iowa may issue highway bonds by submitting a definite program to the voters, said program showing definitely the location and estimates of cost of each section of highway to be improved. In counties of less than 70,000 population the law requires a provision of separate ballot for voters residing in cities and towns from those outside of cities and towns and in order for the proposition to carry the law requires 60 per cent votes in each division. Highway bonds so issued are paid both as to principal and interest from the construction funds and provides for a 7 mill tax derived from tax levy plus receipts from 1 1/3 ct. gas tax.

By vote—paid up by general tax levy.

By vote of the people. They are paid up by gasoline

tax, auto license, property and land tax and by direct taxation.

Anticipation certificates. 3 years.

Only by a vote of the people. Bonds are retired by a bond fund tax levy.

Refer to state code.

MONTANA

By vote of the people, and are retired by levy through the road fund, but the road levy must not exceed 5 mills.

Bond issues for over \$10,000 calls for vote of the people.

Bonds unlawful.

NEW MEXICO

May issue bonds and are paid out of the taxes by making a levy.

Call for bond election. Special tax levy to pay interest and retire bonds.

WHAT IS YOUR OPINION REGARDING THE MATTER OF THE STATE CONTINUALLY TAKING OVER HIGHWAY MILEAGE?

ALABAMA

Bad idea. County roads are for county residents' convenience.

I think it should be done.

ARIZONA

I do not believe that the state should fool with county highway affairs, with the possible exception of standardizing highway construction according to traffic.

States should take over all main highways through state: north and south: east and west.

FLORIDA

Poor business unless main highways. Control of such getting too central and those paying the bill have nothing to say.

It had best be checked soon.

IOWA

Favorable as primary system is completed.

Have been opposed to this; but am not sure now, that the state should not take them all over.

This should be limited to the main through roads inter-county in their nature and possibly stubs out to existing primary roads from fairly good sized towns.

I think that it is right and proper for the state to take over county trunk mileage for the purpose of constructing that mileage to permanent grade, or for the purpose of surfacing road that has previously been put to grade by the county. However, I feel that the practice should be limited to roads of certain importance. We have a number of important roads in this county that might well be taken over by the state as soon as they have sufficient funds with which to improve them, and should they take over our entire trunk road system, it would require several years for them to build and surface that mileage. In that case the county would take over their own Class A local roads and would designate them as trunk roads. A new system of Class A local roads would then be laid out from the ordinary local road system.

I believe a definite policy will need to be adopted soon with respect to the states continually taking over additional mileage of roads. If the local officials are to remain long in the road picture.

The proper procedure.

Should take complete jurisdiction over all highways or let secondary roads alone.

Think it is the right way.

I am of the belief that this procedure has gone far enough in this state except for minor connections. I believe the local authorities can expend money more efficiently and with better economy on secondary roads than the state.

Not so good.

It is our opinion that it is a mistake for the state highway commission to be continually taking over county highway mileage for the reason that it has been our experience that to a large extent only improved roads are taken over, the improvements on which are financed by funds which are 59 per cent direct taxes and 41 per cent gas tax. It is for this reason that we feel that it is a mistake for improved county roads to be continually added to state system unless the counties are refunded at least that part of construction cost which was paid from direct tax levies.

As soon as funds are available the state should take over the roads connecting all towns to complete their system.

Very favorable.

Do not believe that the present revenues of this state should be diverted to the counties. Should be an additional cent gas tax to be used for county work.

Due to increase of revenue obtained from gas tax and motor vehicle licenses tax and lower construction costs the gas tax could, I believe, be supported giving the counties slightly more than the present rates.

The only fair means of appropriating funds to roads within a county is by the amount of traffic the roads carry. I consider a traffic count the only sensible way to determine which particular road should be first built to grade. The only fair way for a state to appropriate funds to the counties is by the cost per mile system. Sections of the state where construction costs amount to an average of \$15,000.00 per mile for earth excavation and bridging should receive more funds than other counties where the costs run an average of \$5,000.00 per mile. This question has been a bone of contention in this state, and no doubt people in the north part of this state, will say that the area basis is the fair way. In that section gravel is found everywhere along the roads, and a three per cent grade is considered to be quite a hill. In our section twenty per cent grades on unimproved roads are not uncommon, and every ton of gravel used in bridge construction and surfacing must be shipped in at a heavy cost.

Counties, it seems to me, should share in federal aid, and get a more equitable portion of both the gasoline and automobile registration fees. It is becoming increasingly difficult to support an adequate secondary road improvement program, when the bulk of the funds must of necessity be raised by local taxation.

Mileage of road.

By additional gas tax.

They are now in Iowa.

Question not clear.

We are getting along pretty good now.

We feel that the state will have additional revenues from auto fees and gas taxes which will not be needed in improvement of an economical primary road system and that such additional funds could be diverted to county highway work in the form of state aid with the highway department having general supervision as to approval of plans.

As specified by law.

Per mile cost of road construction.

Not needed.

MONTANA

Only by using the Washington system.

Think there should be a limit to roads connecting towns above a certain size.

Inadvisable and unsound.

Believe in a state of this size with its thin population that it would be impossible for the state highway department to take over our road system.

State will be pressed for funds to maintain F. A. P. highways as they are completed.

It's the bunk. Local men will spend local money better.

NEW MEXICO

A very good plan in our counties as the state has the machinery.

O. K. in this locality.

HOW COULD MONEY BE FAIRLY DIVERTED TO COUNTY HIGHWAY WORK?

ALABAMA

Rather not discuss this.

From general fund surpluses.

ARIZONA

By levying a tax on gasoline by the state, a portion of which should revert to the county.

Balance of roads to be maintained by counties.

FLORIDA

Minnesota has a good system—to help the counties. Also Florida at last Legislature, 1931, divided 3 ct. of gas tax to counties on valuation, population, area and money spent on state road construction. I think this is a good plan.

Part of gasoline and motor vehicle tax in proportion as paid in.

IOWA

Only the added gas or motor tax or diverted from state when primary system is completed.

License tax monies now diverted to the counties, if 2 ct. of the gas tax were added after completion of the 7 per cent system the counties could bring their highways up to standard.

We get $\frac{3}{4}$ of license plate money and all our county road money.

By gas tax and tobacco tax for each county.

NEW MEXICO

Turn the money over to the state and let the state work road with state machinery and take road work out of the hands of the small politicians.



Every Good Surveyor Knows—

THAT canned tomatoes are both food and drink.

THAT the vernier and lower clamp springs become weak with use, causing an instrument to creep, and that they should be removed and stretched occasionally.

THAT a plumb bob can be quieted by tapping the plumb line with his finger.

THAT the boss does not approve of using the toe of the rodman's boot for a T. P.—*Arizona Highways*.



Things that I felt absolutely sure of a few years ago, I do not believe now; and this thought makes me see more clearly how foolish it would be to expect all men to agree with me.—F. D. Van Amburgh.



About 45,000,000 gallons of road oil are used annually on the 10,000 miles of earth roads in Illinois.

Movable Mail Box Stand Is Designed

A movable mail box stand has been constructed by Superintendent Carl Nelson, and Foreman F. E. Smith of Merced, in District Six and is being used to replace the present stands in that vicinity.

The advantage of this type of stand is that it is easily removed from the shoulder to permit shoulder or road-side grading. The stand is of sufficient weight to stand in place and for removing is tipped and rolled on its base.



—From California Highways and Public Works.

The material used in construction is salvaged or that which is of no further value for use for which it was originally intended.

The base consists of a Ford tire rim picked up along the road. A piece of 2-in. water pipe is used for the riser, one end of which is punched with holes and wire strung through. This is set in the center of the rim and the space filled with concrete. The platform for the box is a piece of 6 by 6-in. guard rail post, the length of which is governed by the number of boxes it is to carry. For one or two boxes it is cut 18 in. long and a 6-in. bevel cut on each end. A hole is bored the size of the pipe and the block slipped on the box or boxes, being fastened either crosswise or lengthwise as the case may be. The stand is given a coat of white paint and presents a very neat appearance. Two accompanying pictures show single and double construction. The third shows their mobility.



More Road Camps Started

Governor Pinchot today announced opening of two State road camps at Pleasant Unity, Westmoreland County, and Kittanning Point, Blair County, to provide work for "able bodied unemployed men."

Similar camps were previously established at Claysville, Washington County, and at Normalville, Fayette County.

Each camp is equipped to accommodate 70 men who are engaged in winter construction of State highways and who are paid hourly wages minus 75 cents a day deducted for their upkeep. The State operates the camp.—*The Pennsylvania Road Builder*.

The Road Builders' News

MANY problems of much importance to the highway industry will come up for consideration at the 29th annual convention of the American Road Builders Association which will be held Jan. 11-15 at Detroit, Mich. Among the pressing subjects that will be considered are the threatened diversion of the gasoline tax to purposes other than roads and streets; the proper budgeting of highway funds; increased federal aid; and increasing the highway building program to provide work for the unemployed. On Monday evening, Jan. 11, there will be an open mass meeting to discuss "Highway Programs and Prosperity." Speakers of national prominence will discuss plans for the stabilization of highway programs and unemployment relief through road building. During the convention a practical plan for the stabilization and expansion of highway programs will be prepared for presentation to congress and the states, counties and cities for their approval and action.

The convention and the road show will be held in the Municipal Airport Building. This building, 1000 ft. long and 200 ft. wide, for exhibit space provides a most imposing display hall, making possible long open aisles that permit the easy circulation of crowds of people. The exposition will be formally opened to delegates and visitors at 9 a. m., Jan. 11.

In conjunction with the convention and road show a number of other association meetings will be held. These include the Associated Equipment Distributors of America, the Truck Association Executives of America, the Association of Asphalt Technologists, and the Consolidated Truck Terminal operators, which will hold an organization meeting.

The first day of the convention will be given up principally to the presentation of committee reports. At 2 p. m., reports will be presented by the following: Committee on Highway Location, Committee on Administrative and Financial Relationship of State and County Roads, Committee on Bins, Batching and Equipment for Handling and Weighing Bulk Cement, City Committee on Pavement Finance.

The program for Tuesday includes the Motor Freight Session, the combined session on plain and reinforced concrete highways, the report of county committee on legislation, ad-



ministration and finance and the report of the City Committee on design and construction; all of these meet at 10 a. m. At 2 p. m. there will be another Motor Freight session, a combined session on maintenance, construction and equipment for low cost roads and bituminous surfaces, the county highway officials session, and the report of the City Committee on maintenance.

On Wednesday morning there will be reports by the committee on recent practical developments in the design and construction of brick pavements and by the committee on central and truck mixed concrete. There also will be a session of the highway contractors, and a combined session of city traffic and traffic devices and their application. In the afternoon there will be a combined report by the County Committee on design and construction and the County Committee on maintenance. The City Committee on airports also will submit its report. The Pan-American session will be held at 2 p. m. and likewise a session of highway contractors.

The program for Thursday includes the following: Meeting Association of Asphalt Paving Technologists; report on recent developments in design and construction of low cost bridge; a session on grading methods; the city officials session.

All of this takes place in the morning. In the afternoon there will be a combined session on equipment, another meeting of the Association of Asphalt Paving Technologists, and business meetings of county highway officials division, manufacturers division, and the American Road Builders Association.

The entertainment features include the road builders banquet on Jan. 13 with provision for 1000 guests, and the international ball on Jan. 14. Separate dinners will be given by the city and county highway officials' divisions on Jan. 11. The county highway officials' division dinner will be at the Book-Cadillac hotel, and the city officials' dinner will be held at the Statler. A reception and tea honoring the dele-

gates from Canada will be the first event of the week on Jan. 10. This event will be attended by delegates from all parts of the country and abroad.

The program of the convention follows:

Sunday, January 10, 1932

4:00 p. m.—Reception honoring delegates from Canada. Book-Cadillac Hotel.

Monday, January 11, 1932

SESSION ON HIGHWAY LOCATION

Monday Afternoon, 2:00

Meeting Room No. 1, Municipal Airport Building

Presiding—R. Getty Browning, Principal Locating and Claim Engineer, North Carolina State Highway Commission, Raleigh, N. C. Chairman, Committee on Highway Location—Recent Developments in Surveying Methods and Equipment.

Report of Committee on Highway Location—Recent Developments in Surveying Methods and Equipment.

1. Aerial Surveying, Colonel R. R. Ralston, Federal Bureau of Maps and Surveys, Washington, D. C.

2. Experience with Aerial Surveys, Gibb Gilchrist, Chief Engineer, Texas State Highway Department, Austin, Tex.

3. Instruments for Highway Surveying, H. M. Diebert, Sales Manager, W. & L. E. Gurley, Troy, N. Y.

4. Methods and Equipment Used on Recent Surveys, Henry H. Blood, Chairman, Utah State Road Commission, Salt Lake City, Utah.

SESSION ON ADMINISTRATIVE RELATIONSHIP OF STATE AND COUNTY

Monday Afternoon, 2:00

Meeting Room No. 3, Municipal Airport Building

Presiding—George F. Schlesinger, Chief Engineer and Managing Director, National Paving Brick Association, Washington, D. C.

Report of Committee on Administrative and Financial Relationship of State and County, Arthur W. Brandt, Chairman, State Highway Commissioner, Albany, N. Y.

SESSION ON BINS, BATCHERS AND EQUIPMENT FOR HANDLING AND WEIGHING BULK CEMENT

Monday Afternoon, 2:00

Meeting Room No. 2, Municipal Airport Building

Presiding—Roy Crum, Director, Highway Research Board, National Research Council, Washington, D. C.

Report of Committee on Bins, Batchers and Equipment for Handling and Weighing Bulk Cement, P. M. Tebbs, Chairman, Assistant Chief Engineer, Pennsylvania Department of Highways, Harrisburg, Pa.

"Use of Bulk Cement," Herbert Coffman, Research Engineer, Hercules Cement Corporation, Philadelphia, Pa.

CITY OFFICIALS' SESSION

Monday Afternoon, 2:00

Meeting Room No. 4, Municipal Airport Building

Presiding—A. Harrington Place, Engineer, Detroit Bureau of Governmental Research, Detroit, Mich. Chairman of Committee.

Report of Committee on Pavement Finance.

(a) What portion of the cost of a pavement should be borne by the general public in

1. Initial pavements
2. Repavement
3. Resurfacing

(b) Source of revenue from which to pay the general public's portion of this cost.

Monday Evening, 6:00

Book-Cadillac Hotel

County Highway Officials' Dinner.

Monday Evening, 6:00

Statler Hotel

City Officials' Dinner.

Monday Evening, 8:15

"Highway Programs and Prosperity." An open mass meeting to discuss important policies affecting highway activities.

Tuesday, January 12, 1932

SESSION ON MOTOR FREIGHT

Tuesday Morning, 10:00

Meeting Room No. 1, Municipal Airport Building

Presiding—J. X. Galvin, President, Penoyer Merchants Transfer Co., Chicago, Ill.

"Utility of the Highway," Harold S. Shertz, Counsel, Interstate Motor Carriers Association, Philadelphia, Pa.

"Coordination of Highway and Railroad Transportation," Samuel O. Dunn, Editor, *Railway Age*, Chicago, Ill.

"Truck Taxation," Edward F. Loomis, Secretary, Motor Truck Committee, National Automobile Chamber of Commerce, New York, N. Y.

COMBINED SESSION ON PLAIN AND REINFORCED CONCRETE HIGHWAYS

Tuesday Morning, 10:00

Meeting Room No. 2, Municipal Airport Building

Presiding—T. H. Cutler, Chief Engineer, Missouri State Highways Commission, Jefferson City, Mo.

Report of Committee on Recent Practical Developments in Design and Construction of Concrete Highways, H. F. Clemmer, Chairman, Engineer of Tests and Materials, Engineer Department, District of Columbia, Washington, D. C.

Report of Committee on Recent Practical Developments in Design and Construction of Reinforced Concrete Pavements and Bases, C. E. Foster, Chairman, Chief Engineer, Michigan State Highway Department, Lansing, Mich.

"The Field of Use for Single Track Concrete Roads," E. M. Fleming, Manager, Highways and Municipal Bureau, Portland Cement Association, Chicago, Ill.

COUNTY HIGHWAY OFFICIALS' SESSION

Tuesday Morning, 10:00

Committee Room No. 3, Municipal Airport Building

Presiding—H. G. Sours, Vice-President, Central Division, County Highway Officials' Division; County Engineer, Summit County, Akron, O.

Report of Committee on Legislation, Administration and Finance, W. O. Washington, Chairman, County Engineer, Cameron County, Brownsville, Tex.

- (a) Uniform Accounting.
- (b) Purchasing Equipment Practices.
- (c) General Requirements—Specification Forms.
- (d) Methods of State Aid Extension.

CITY OFFICIALS' SESSION

Tuesday Morning, 10:00

Committee Room No. 4, Municipal Airport Building

Presiding—Harry L. Shaner, Commissioner of Public Works, Winston-Salem, N. C., Chairman of Committee.

Report of Committee on Design and Construction

- (a) Street Railway Track Pavement Design.
- (b) Contraction and Expansion in Pavement Bases.
- (c) Resurfacing of Pavements Designed for Traffic in Residential Areas to Enable Such Pavements to Carry Heavier Traffic.
- (d) Subgrades.

SESSION ON MOTOR FREIGHT

Tuesday Afternoon, 2:00

Meeting Room No. 1, Municipal Airport Building

Presiding—J. X. Galvin, President, Penoyer Merchants Transfer Co., Chicago, Ill.

"Social and Industrial Economics of Motor Distribution," Tom Snyder, Secretary, Truck Association Executives of America; President, Warehouse Distributing Corporation of America, Indianapolis, Ind.

"Fifteen to Fifty Per Cent Saving on Tires," G. M. Sprowls, Manager, Highway Transportation, Goodyear Tire & Rubber Co., Inc., Akron, O.

"Insurance," W. O. Dilks, Specialist, Casualty and Transportation Insurance, Philadelphia, Pa.

COMBINED SESSION ON MAINTENANCE, CONSTRUCTION AND EQUIPMENT FOR LOW COST ROADS AND BITUMINOUS SURFACES

Tuesday Afternoon, 2:00

Committee Room No. 2, Municipal Airport Building

Presiding—A. T. Goldbeck, Director, Bureau of Engineering, National Crushed Stone Association, Washington, D. C.

Report of Committee on Recent Practical Developments in Design and Construction of Low Cost Road Surfaces, Grover C. Snyder, Chairman, Chief Engineer of Maintenance, Ohio Department of Highways, Columbus, O.

"Use of Emulsions in Low-Cost Road Construction," C. L. McKesson, Director, Research and Engineering, American Bitumuls, San Francisco, Calif.

Report of Committee on Equipment for Construction and Maintenance of Low

Cost Road Surfaces, John D. Waldrop, Chairman, State Construction Engineer, North Carolina State Highway Department, Raleigh, N. C.

Discussion by Hugh Skidmore, Consulting Engineer, Chicago Testing Laboratory, Chicago, Ill.

Report of Committee on Recent Practical Developments in Design and Construction of Asphalt Pavements, R. L. Morrison, Chairman, Professor of Highway Engineering and Highway Transport, University of Michigan, Ann Arbor, Mich.

(a) Hot Mix, R. L. Morrison, Professor of Highway Engineering and Highway Transport, University of Michigan, Ann Arbor, Mich.

(b) Cold Mix, Harry L. Rex, Assistant Engineer of Materials, Highway Department, District of Columbia, Washington, D. C.

COUNTY HIGHWAY OFFICIALS' SESSION

Tuesday Afternoon, 2:00

Meeting Room No. 3, Municipal Airport Building

Presiding—H. B. Keasbey, Vice-President, Northeastern District, County Highway Officials' Division; County Engineer, Salem County, Salem, N. J.

Report of Committee on Public Relations, Otto S. Hess, Chairman, Engineer-Manager, County Road Commission, Kent County, Grand Rapids, Mich.

(a) Methods of Promoting Bond Issues. Report of Committee on Regional Surveys and Plans, E. A. Griffith, Chairman, Chief Engineer of Roads, Allegheny County, Pittsburgh, Pa.

(a) County Manual Outlining Planning Procedure.

(b) Standard Legislation Enabling Acts.

(c) Aerial Photographs.

CITY OFFICIALS' SESSION

Tuesday Afternoon, 2:00

Committee Room No. 4, Municipal Airport Building

Presiding—Major F. M. Davison, Maintenance Engineer, District of Columbia, Washington, D. C., Chairman of Committee.

Report of Committee on Maintenance.

(a) Control of Utility Cuts in Pavements.

(b) Low Cost Residential Roadways as Constructed by Maintenance Departments.

(c) The Repair and Reclamation of Sheet Asphalt Streets Using the Surface Heater Method.

(d) Maintenance Methods and Materials as Practiced in Washington, D. C.

Wednesday, January 13, 1932

SESSION ON BRICK PAVEMENTS

Wednesday Morning, 10:00

Committee Room No. 3, Municipal Airport Building

Presiding—Atlee Wise, County Engineer, Stark County, Canton, O.

Report of Committee on Recent Practical Developments in Design and Construction of Brick Pavements, H. G. Sours, Chairman, County Engineer, Summit County, Akron, O.

SESSION ON CENTRAL AND TRUCK MIXED
CONCRETE**Wednesday Morning, 10:00***Committee Room No. 1, Municipal Air-
port Building*

Presiding—H. F. Thompson, Vice-President, Ready Mixed Concrete Association, St. Louis, Mo.

Report of Committee on Central and Truck Mixed Concrete, Colonel R. Keith Compton, Chairman, Director of Public Works, Richmond, Va.

COMBINED SESSION ON CITY TRAFFIC AND
TRAFFIC DEVICES**Wednesday Morning, 10:00***Committee Room No. 4, Municipal Air-
port Building*

Presiding—M. O. Eldridge, Assistant Director of Traffic, District of Columbia, Washington, D. C.; Chairman of City Committee on Traffic.

Report of City Committee on Traffic.

(a) Interpretation of the General Concept of Right of Way as Applied to the Operation of Motor Vehicles in Traffic.

(b) Building Safety Into Highways—or Reducing Accidents and Congestion by Proper Design.

(c) Laning of Traffic.

(d) Radii of Curbs at Intersections.

(e) Safety Zones—Recommended Design with Paving and Lighting Problems.

(f) Traffic Control at Circles and Multiple Intersections.

Report of Committee on Traffic Devices and Their Application, Harry E. Neal, Chairman, Traffic Engineer, Ohio Department of Highways, Columbus, O.

HIGHWAY CONTRACTORS' SESSION

Wednesday Morning, 10:00*Committee Room No. 2, Municipal Air-
port Building*

Presiding—E. J. Mehren, President, Portland Cement Association, Chicago, Ill.

"Highway Maintenance and Secondary Road Construction by Contract," Harry J. Kirk, Assistant Manager, Engineering Construction Divisions, Associated General Contractors of America, Inc., Washington, D. C.

"Fifteen to Fifty Per Cent Saving on Tires," G. M. Sprowls, Manager, Highway Transportation, Goodyear Tire & Rubber Co., Inc., Akron, O.

Report of Committee on Standardization of Rental Rates for State-Owned Equipment, and Establishment of Relationship Between These Rentals and Those Recommended for Privately-Owned Equipment, C. P. Owens, Chairman, Maintenance Engineer, Missouri State Highway Department, Jefferson City, Mo.

"Stabilization of the Highway Program," Charles H. Duncan, Secretary, Ohio Contractors Association, Columbus, O.

COUNTY HIGHWAY OFFICIALS' SESSION

Wednesday Afternoon, 2:00*Committee Room No. 3, Municipal Air-
port Building*

Presiding—W. O. Washington, Vice-President, Southern District, County Highway Officials' Division; County Engineer, Cameron County, Brownsville, Tex.

Report of Committee on Design and Construction and Committee on Maintenance (combined report), Chas. A. Browne, Chairman, Committee on Design and Construction, Chief Engineer, Orange County, Orlando, Fla. H. G. Sours, Chairman, Committee on Maintenance, County Engineer, Summit County, Akron, O.

(a) Widening and Reconstructing.

(b) Surface Treatment Specification.

CITY OFFICIALS' SESSION

Wednesday Afternoon, 2:00*Committee Room No. 4, Municipal Air-
port Building*

Presiding—Colonel H. L. Blee, Director of Aeronautics, U. S. Department of Commerce, Washington, D. C. Major D. A. Davison, Assistant Engineer Commissioner, District of Columbia, Washington, D. C.; Chairman of Committee on Airports.

Drainage and Surfacing of Airports.

PAN-AMERICAN SESSION

Wednesday Afternoon, 2:00*Committee Room No. 1, Municipal Air-
port Building*

Presiding—M. A. Corroalles, President, Pan-American Division; Chief Engineer of Roads and Bridges, Havana, Cuba.

Revised Spanish-American Vocabulary, Jose Rivera R., Secretary, Pan-American Division, Mexico, D. F.

"Highway Financing in Mexico," Bece-rill Colin, Engineer, National Highway Commission of Mexico, Mexico, D. F.

Translations of Condensed Reports Presented by Various Committees at Convention.

HIGHWAY CONTRACTORS' SESSION

Wednesday Afternoon, 2:00*Committee Room No. 2, Municipal Air-
port Building*

Presiding—J. E. Pennybacker, Managing Director, the Asphalt Institute, New York, N. Y.

"Wage Rates on Highway Work," O. W. Merrell, Director, Ohio Department of Highways, Columbus, O.

"Preferential Awarding of Contracts to Local Contractors," Frederick Hoitt, Secretary, New England Road Builders Association, Boston, Mass.

"The Question of Replacing Machinery with Hand Labor to Relieve Unemployment," W. T. Chevalier, Publishing Director, Civil Engineering Publications, McGraw-Hill Publishing Co., New York.

Wednesday Evening, 7:30*Book-Cadillac Hotel*

Road Builders' Banquet.

Thursday, January 14, 1932

SESSION ON GRADING METHODS

Thursday Morning, 10:00*Meeting Room No. 2, Municipal Airport
Building*

Presiding—H. J. Spelman, Senior Highway Engineer, United States Bureau of Public Roads, Washington, D. C.

Report of Committee on Compaction of Earth Fills as Affected by Type and Size of Haulage and Other Equipment, J. T. Ellison, Chairman, Chief Engineer, Minnesota Department of Highways, St. Paul, Minn.

"Construction of Earth Fills Across Land Subject to Subsidence," M. W. Torkelson, Acting State Highway Engineer of Wisconsin, Madison, Wis.

SESSION ON LOW COST BRIDGES

Thursday Morning, 10:00*Meeting Room No. 3, Municipal Airport
Building*

Presiding—H. K. Bishop, Chief, Division of Construction, U. S. Bureau of Public Roads, Washington, D. C.

"Recent Practical Developments in Design and Construction of Low Cost Bridges," Searcy B. Slack, Author of Report, Bridge Engineer, Georgia State Highway Board, East Point, Ga.

"Strengthening Iron and Steel Highway Bridges by Welding," Prof. F. P. McKibben, Senior Vice-President, American Welding Society, New York, N. Y.

CITY OFFICIALS' SESSION

Thursday Morning, 10:00*Meeting Room No. 4, Municipal Airport
Building*

Presiding—Geo. B. Sowers, President, City Officials' Division; Commissioner of Engineering and Construction, Cleveland, O.

Meeting, National Committee on Standards for Street Maintenance.

Business Meeting, City Officials' Division.

Meeting, Board of Directors, City Officials' Division.

COMBINED SESSION ON EQUIPMENT

Thursday Afternoon, 2:00*Meeting Room No. 2, Municipal Airport
Building*

Presiding—M. de Glopper, Deputy Commissioner, Michigan State Highway Department, Lansing, Mich.

Report of Committee on Standardization of Shoes for Truck and Tractor Snow Plows, W. F. Rosenwald, Chairman of Highways, St. Paul, Minn., Maintenance Engineer, Minnesota Department.

Report of Committee on Standardization of Blades for Truck Scrapers, B. C. Tiney, Chairman, Maintenance Engineer, Michigan State Highway Department, Lansing, Mich.

Report of Committee on Equipment for Spreading and Finishing Pavement Surfaces, O. L. Kipp, Chairman, Construction Engineer, Minnesota Department of Highways, St. Paul, Minn.

Discussion, Major F. M. Davison, Maintenance Engineer, District of Columbia, Washington, D. C.

Thursday Afternoon, 12:30

Luncheon Meeting, Board of Directors, American Road Builders' Association.

COUNTY HIGHWAY OFFICIALS' SESSION

Thursday Afternoon, 2:00*Meeting Room No. 3, Municipal Airport
Building*

Presiding—O. S. Hess, President, County Highway Officials' Division; Engineer-Manager, County Road Commission, Kent County, Grand Rapids, Mich.

Business Meeting, County Highway Officials' Division.

Meeting, Board of Directors, County Highway Officials' Division.

Thursday Afternoon, 2:30

Meeting Room No. 4, Municipal Airport Building

Business Meeting, Manufacturers' Division.

Thursday Afternoon, 4:30

Meeting Room No. 4, Municipal Airport Building

Business Meeting, American Road Builders' Association.

Thursday Evening, 6:30

Book-Cadillac Hotel

Round Table Publicity Conference on Highway Program Extension.

Thursday Evening, 9:00

Statler Hotel

International Ball.

Concurrent Association Meetings**TRUCK ASSOCIATION EXECUTIVES OF AMERICA**

The Truck Association Executives of America will hold their annual convention in Detroit January 11th and 12th at the Book-Cadillac Hotel. They have invited the consolidated truck terminal operators of the United States to meet with them.

ASSOCIATED EQUIPMENT DISTRIBUTORS

The Associated Equipment Distributors will hold their annual meeting in Detroit January 9th and 10th at the Book-Cadillac Hotel.

ASSOCIATION OF ASPHALT PAVING TECHNOLOGISTS

The Association of Asphalt Paving Technologists will hold their annual meet-

ing in Detroit January 14th in the Municipal Airport Building. The program of the meeting prepared by the Association of Asphalt Paving Technologists follows:

Thursday Morning, 10:00

Meeting Room No. 1, Municipal Airport Building

Presiding—Charles A. Mullen, President, The Association of Asphalt Paving Technologists, Montreal, Canada.

Address—Charles A. Mullen, President, The Association of Asphalt Paving Technologists, Montreal, Canada.

Progress Report of Committee on Present Practice in Asphalt Paving, Roger L. Morrison, Chairman, Professor of Highway Engineering and Highway Transport, University of Michigan, Ann Arbor, Mich.

Progress Report on Investigation Into Causes of Cracking in Sheet Asphalt, F. J. Leduc, Consulting Engineer, Montreal, Canada.

Development of Rotary Mixers for Hot and Cold Asphalt Paving Mixtures, John W. Davitt, Consulting Engineer, Jersey City, N. J.

A Discussion Concerning Adhesion Tension in Asphalt Pavements, Its Significance and Methods Applicable in Its Determination, Victor Nicholson, Engineering Chemist, Bureau of Streets, Chicago, Ill.

"A New Method of Mixing and Placing Modern Pavements," George W. Craig, Consulting Engineer, Chicago, Ill.

Thursday Afternoon, 2:00

Meeting Room No. 1, Municipal Airport Building

Presiding—Henry L. Howe, First Vice-President, The Association of Asphalt Paving Technologists, Rochester, N. Y.

"Some of the Fundamental Physical Characteristics of Mineral Fillers Intended for Asphalt Paving Mixtures," J. S. Miller, Director, Technical Bureau, The Barber Asphalt Co., Maurer, N. J. R. N. Traxler, Research Chemist, Technical Bureau, The Barber Asphalt Co., Maurer, N. J.

Progress Report on Cooperative Simplification of Tests and Specifications of Liquid Asphaltic Products, J. T. Pauls, Senior Highway Engineer, U. S. Bureau of Public Roads, Washington, D. C.

Relative Significance of Origin and Process of Manufacturing as Affecting the Characteristics of Asphalt, C. M. Baskin, Asphalt Technologist, Imperial Oil Refineries, Limited, Montreal, Canada.

Oiling Earth Roads and Subgrades in Missouri, F. V. Reagel, Engineer of Materials, Missouri State Highway Department, Jefferson City, Mo.

"Researches on Stability of Cold Bituminous Mixtures," C. R. Stokes, Materials Engineer, Wisconsin Highway Commission, Madison, Wis.

Adaptation of the Stability Test to Include Coarse Aggregate Asphalt Paving Mixtures, Prevost Hubbard, Chemical Engineer, The Asphalt Institute, New York, N. Y. F. C. Field, chemist, The Asphalt Institute, New York, N. Y.

Unemployment Relief Scheme of Ottumwa, Iowa, Told by Mayor Edwin Manning

Last winter we worked approximately 600 men taking rock from the Des Moines River, thereby helping our hydro-electric plant; giving work to the men, and crushing the rock to be used in construction of streets, alleys, and park roads. We worked these men in shifts of 150 per day and a half, paying them 40c per hour. That meant that 600 men earned \$5.00 per week in public work. We worked from December to April of this year (1930).

In June of this year we called together about seventy representative wholesalers, manufacturers, retailers, labor men and bankers, in the city hall to get an early start for this fall and winter, feeling that something had to be done in a public way. Out of that meeting the mayor was authorized to appoint a committee of eleven which has since been increased by a few additions. Mr. C. S. Harper, President of Harper-McIntire Wholesale Hardware Company, was appointed General Chairman. He in turn appointed several committees such as public works, a committee to co-operate with the Overseer of the Poor and Social Service, and one or two other minor committees. They held meetings in July and made recommendations, among which was that the City Council do practically the same thing this year as last, and in addition, cooperate with the River Front Commission and build a sea wall along the bank of the

Des Moines River. Practically all of our citizens are back of this movement, and inasmuch as the State Executive Council gave its approval on the 27th of October to this plan, we intend to start just as soon as the river recedes. We have also opened a Free Employment Agency and have approximately 1000 men registered. Each registered unemployed citizen is issued an identification card.

In past seasons it has been customary for various church organizations to hold rummage sales, but this year they have abandoned this practice, and with the assistance of the Boy Scouts, all clothing is being gathered and taken to the Free Employment Agency for free distribution to the needy.

We intend to take care of our own people in Ottumwa this winter, either by public work or private funds for the needy who cannot work. We will not give any relief except in the way of work. The Community Chest, Social Service Bureau, County Poor Fund, Free Employment Agency and the city are all working hand in hand in cross-checking the cards. We feel that we were one of the few communities in Iowa to organize for the coming winter, and have the situation well in hand. We are not asking for outside relief, and in turn, are not going to employ anyone except residents of the City of Ottumwa.

Equipment and Materials on Display at the 1932 Road Show

IN the following pages **ROADS AND STREETS** presents its annual preview of the Road Show exhibits. All the exhibits are described upon which information was available up to the time of going to press.

Aeroil to Show New Power Spray Machine

The Aeroil Burner Co., Inc., West New York, N. J., will have the following equipment on exhibit: Concrete curing spray outfit, oil burners for road oil, distributors, asphalt kettles, maintenance heaters, pouring



Aeroil Power Spray Machine

pots, concrete heaters, thawing torches, water heaters and weed burners.

A new product that will be exhibited is a power spray machine. This is a compact and easily portable machine that pumps the liquid direct from the drum or barrel to the spray gun at a pressure ranging from 20 lb. to 70 lb. No pressure is applied to the barrel or drum. It is equipped with a gasoline engine, a geared pump unit, priming funnel, pressure gauge, 2½ ft. supply hose from drum to pump unit, a 15 ft. length of ¾-in. spray hose, a 4 ft. spray gun with bronze nozzle and a special lever type valve which controls the spray and permits the operator to instantly shut-off the flow of liquid by merely releasing the pressure on the handle.

The exhibit will be in Space No. 419 and will be in charge of Geo. P. Kittel with the assistance of R. S. Arthur, Chicago branch manager.

Aluminum Co. of America Exhibit

The exhibit of the Aluminum Company of America, Pittsburgh, Pa., will be in charge of I. L. Dobyns,

Pittsburgh. Others who will be in attendance include: Frank D. Goll, Pittsburgh; F. L. Gemmer, Pittsburgh; W. R. Butler, Milwaukee; D. A. Benner, St. Louis; L. P. Favorite, Detroit; E. E. Yahn, Detroit.

American Bitumuls to Show Miniature Surface Treatment Outfit

The American Bitumuls Co., San Francisco, Calif., will exhibit a miniature surface treatment outfit, consisting of a road bed, with the necessary background, distributor, trucks, etc., shown in such a manner as to create the illusion of actual motion of the above mentioned pieces of equipment. Demonstrations of the application of the various emulsions with a hand spray pump and pouring pots will be given and a motion picture machine will be used to show actual construction of important bitumuls projects in different parts of the country. Samples of the various types of emulsions will be demonstrated.

The exhibit will be in Booth No. 461 and the following representatives will be in attendance: P. L. Fahrney, General Sales Manager; P. L. Boneysteele, District Manager; Theo. A. Timchac, Sales Engineer, Michigan; F. L. Reed, Construction Engineer, Ohio; C. D. Jones, Sales Engineer, Virginia; M. L. McKercher, Construction Engineer, Ohio; C. L. McKesson, Research Engineer, from the executive offices, will present a paper at the convention and also will be in attendance at the exhibit.

American Fork & Hoe Co. to Exhibit Hand Shovels

The American Fork & Hoe Co., Cleveland, O., will exhibit its standard line of hand shovels such as used for general contractors, road builders and highway work. H. C. Branahl, manager of Sales Shovel Division, will be in charge of this exhibit. In addition the Detroit representative, C. B. Myers, will be present during the convention.

Ames Baldwin Wyoming Shovel Co.

The Ames Baldwin Wyoming Shovel Co., North Easton, Mass., will exhibit a complete line of shovels, scoops and picks for contractors, including such brands as Red edge, genuine O-Ames, Monongah and Pony.

Anthony Co. to Show New Equipment

The exhibit of the Anthony Co., Streator, Ill., in Space No. 246 will show many new achievements and features in hydraulic hoists and bodies. The shaker or muck remover, which is incorporated in all Anthony pipeless hydraulic hoists will be shown and demonstrated. The shaker is automatic and operates when the body reaches full dumped position, shaking to dislodge sticky or clinging loads. The degree of shake is controlled by the driver through the motor speed. The shaking is caused by an automatic valve within the cylinder opening and closing making pressures vary at regular intervals causing the body to shake. Basic patents on the shaker are owned by the Anthony Company, thus making this an exclusive Anthony feature.

Also will be shown a new slant type pipeless hydraulic hoist for 1 and 1½ ton chassis. This is a heavy duty hoist, in which is used a 6-in. cylinder and it will handle continually all that the chassis itself will stand. The hoist pushes directly against the load, raising the body to a 55° angle. The Anthony Co. also have developed and will show heavy duty pipeless hydraulic hoist for 2, 2½, 3 and 3½ ton trucks. In their heavy duty line is embodied the pipeless feature. Also will be shown the Anthony cam type pipeless hydraulic hoist for 1½-ton trucks. Many other features have been added to the Anthony line, such as heavier and stronger bodies, new type double acting tailgate, etc.

The Asphalt Institute Exhibit

The exhibit of The Asphalt Institute, New York, N. Y., will consist of a number of display charts and

diagrams and a table exhibit showing some of the latest developments of the stability test in connection with coarse aggregate asphalt mixtures. In addition there will be a number of films on both low cost and high type asphalt construction. The exhibit will be located in Booth No. 108. Representatives present during the Road Show will consist of Mr. Pennybacker, Mr. Field, Mr. Krieger and Mr. Hubbard.

Armco to Exhibit New Products

Multi-Plate Pipe, a most recent development in drainage structures, Armco metal cribbing, and Armco paved invert pipe, will be the main attractions of the exhibit of the



Installing Armco Multi-Plate Pipe

Armco Culvert Mfrs. Assn., Middletown, O.

Multi-Plate Pipe, which is similar to the usual corrugated metal culvert, is made of plates stated to be heavier than ever before used in this type of construction. Punched, formed to shape, and galvanized in the factory, the Ingot Iron plates used in this new pipe are bolted together on the job to form pipe in diameters up to 10 feet.

Metal cribbing is designed and fabricated so that it can be installed by unskilled labor. This cribbing is stated to be particularly suited for highway and railway retaining walls, especially in cities at grade crossings, etc., for bridge wingwalls, and for river and harbor bank protection work. Years of actual service for Armco paved invert pipe has shown the value of balanced design—reinforcement at the point of greatest wear. This period of service has also shown that greater protection could be gained by increasing the width of the pavement. Armco paved invert pipe is now provided with a pavement of uniform thickness proportionate in width to the diameter of the pipe. This smooth, wear-resisting bituminous material in the bottom of the culvert resists the

concentrated erosive action of abrasive materials.

This display will be located in Booth 201. The following representatives of the Armco Culvert Mfrs. Assn. will be in attendance: S. R. Ives, Vice President and General Manager; Geo. E. Shafer, Engineer of Tests; M. C. Noble, Eugene Keller, Regional Managers; W. H. Spindler, R. E. Pearson, Publicity Division.

Barber-Greene to Feature New Bituminous Paver and Finisher

Barber-Greene Co., Aurora, Ill., will exhibit its bituminous paver and finisher. This is a new machine that in a single continuous operation, and without the use of forms, builds bituminous roads. In addition to the paver, which will be seen outside the exhibit hall, near the entrance, the Barber-Greene Co. will have Booth No. 134. At the booth there will be moving pictures of B-G Pavers, showing them on various jobs.

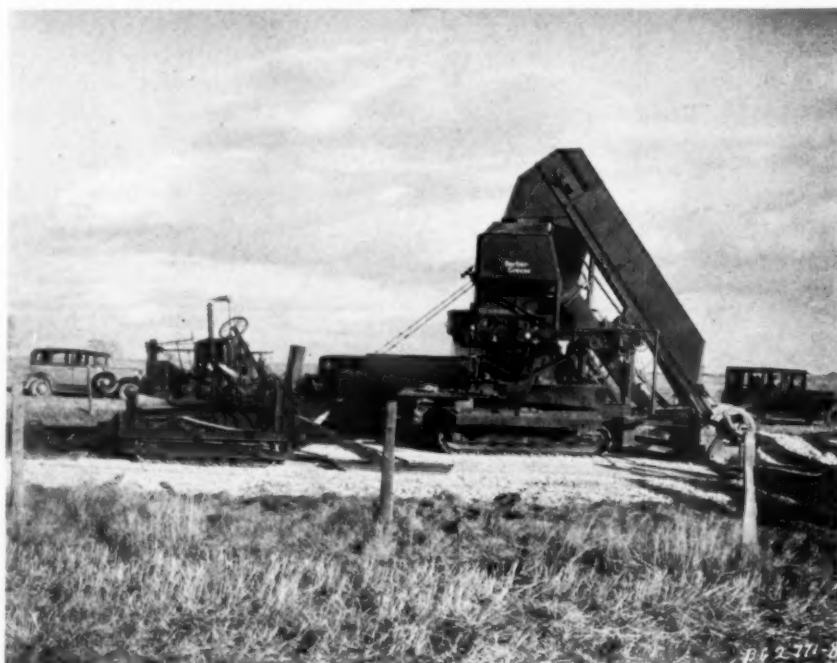
The Barber-Greene bituminous paver is made up of two units, the loader-mixer and the spreader-tamper. Each unit is crawler mounted and moves under its own power. The loader-mixer is similar in appearance to a Barber-Greene bucket loader but is equipped with a spiral-pickup feeder, a measuring hopper, a bitumen spray, and a twin pug mill mixer.

In building road, the aggregate is placed in a windrow down the center of the road. The loader-mixer moves along picking up this aggregate,

spraying it thoroughly with bitumen, accurately proportioning and mixing the bituminous concrete, and discharging it into or in front of the spreader-tamper. To get a uniform, predetermined mixture the aggregate is fed through a calibrated gate on an apron conveyor, which forms the bottom of the hopper in which it is stored, and dropped through a system of baffles and bitumen spray nozzles into the pug mill. The flow of bitumen to these nozzles is constantly metered, and is controlled by a valve. Bitumen is supplied by a distributor truck.

The spreader-tamper unit is a machine which spans the road behind the loader-mixer. The material is delivered to the center of the spreader from which point it is carried across the road bed in both directions by means of two horizontal screw conveyors, operating in opposite directions. These may be operated independently to compensate for uneven distribution or consumption. Behind the screws is a tamper with a 1½-in. face and a screed with a 6-in. face. The screed follows the tamper. Approximately 6,000 lb. weight is stated to be on the tamper at the bottom of its down stroke, and the material is firmly tucked under the screed. The spreader-tamper is easily adjusted for different thicknesses of road, crowns, or super elevations while the machine is running.

An ingenious arrangement of shoes and eveners levers extending before and behind each crawler produces a finished surface without the use of forms.



Barber-Greene Bituminous Paver

Members of the Barber-Greene organization who will attend the Road Show are, H. H. Barber, President; W. B. Greene, Vice-President; F. D. Hooper, Sales Manager; C. B. Gould, Barber-Greene District Manager for Detroit, and Jack Turner, Publicity Manager.

Barrett Exhibit

A standard feature of the Road Show for several years has been the Barrett Tarvia distributor with its load of sweet cider which is served to all comers. This will again be the central feature of the Barrett exhibit.

In addition the latest and most modern methods of using Tarvia will be illustrated and demonstrated by diagrams, models, photographs, and moving pictures. The construction of all sorts of Tarvia roads will be fully set forth. Actual samples of existing Tarvia roads will be a part of the exhibit. Barrett engineers from all parts of the territory will be present to give the benefit of their wide experience in road building and maintenance.

Bay City to Show $\frac{3}{8}$ -Yd. Full Revolving Shovel

The Bay City Shovels, Inc., Bay City, Mich., will exhibit one full revolving machine of $\frac{3}{8}$ -yd. capacity and a trailer moving device for power shovels up to 15 tons in weight. The exhibit will be in Space No. 132.

Barber Asphalt Exhibit

The Barber Asphalt Co., Philadelphia, Pa., has been assigned Space No. 107. It is planned to distribute advertising matter featuring Trinidad and Bermudez native lake asphalts as well as "Curcrete," an asphalt emulsion used for curing portland cement concrete roads. The space allotted measures 20 x 15 ft. and will be furnished with chairs, etc., for the comfort of customers and friends. It is expected that C. W. Bayliss, Vice President; R. C. Heath, Manager, Street and Road Department; H. J. Wells, District Manager, Chicago; W. F. Hartzell, Advertising Manager, and a number of representatives of the Street and Road Department will attend the exhibit.

Beach to Exhibit New Equipment

Beach Manufacturing Co., Charlotte, Mich., will exhibit, in addition to its usual line, an entirely new

piece of equipment. This is known as the "Beach Combine." This is an arrangement whereby during the winter Beach quadruple blade road maintainer is removed and the same hoist and worm gear (operated from inside of cab) is used to operate the snow plow. The plow and wing are so built that when the blade of plow or wing strikes a stationary or immovable object they instantly shoot up until the object is passed and then immediately drops to working position. In light snow both front plow and wings are used. Where heavy drifts have formed only the plow is used. After this is done the wing only is used.

Black & Decker to Show New Loadometer

The Black & Decker Mfg. Co., Towson, Md., will show its new turtle-back drive-on loadometer and test loadometer, also a line of portable electric tools for truck and road building machinery maintenance.



New Turtleback Drive-on Loadometer

The exhibit will be at Space No. 401. Those in attendance will be E. E. Powell, H. L. Prince and F. J. Troll.

Blaw-Knox Exhibit

Blaw-Knox Company, Pittsburgh, Pa., will occupy Space No. 119. Equipment on display will consist of the following items:

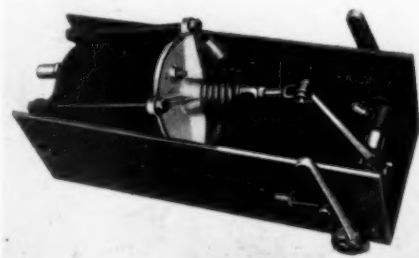
Improved Ord finisher with 4-cylinder motor. This will be a 9-10 ft. adjustable machine equipped with double screed and tamper. A Blaw-Knox aggregate weighing batcher. A Blaw-Knox cement weighing batcher. A display of Blaw-Knox road forms showing a complete range of types and sizes. Also an exhibit of Blaw-Knox street and sidewalk forms. Blaw-Knox clamshell buckets. The Blaw-Knox "Ateco" hydraulic scraper.

The Blaw-Knox booth will be complete with its exhibit of the

equipment listed above and a pictorial display illustrative and descriptive of the complete Blaw-Knox line of batcherplants, bulk cement plants, truckmixers, agitator-truck bodies, ready mixed concrete plants, Ord asphalt finishers, truck turntables, cement tanks, wagon graders, dragline buckets, tamping rollers, scarifiers, and bulldozers.

Bragg-Kliesbrath Corp. Exhibit

The principal exhibit of the Bragg-Kliesbrath Corporation, South Bend, Ind., will consist of two Timken axles with the power brake units set up. This will be the first showing of the new trailer brake axle combination. The corporation at present is sponsoring a conversion program



New Box Type Booster Kit

for this unit. This will be of special interest to road builders, as it represents an important offering of complete power brake equipment for trailers. The exhibit will be in Space No. 456C and will be in charge of W. E. Babler, District Manager.

Broderick & Bascom Rope Co. Exhibit

Broderick & Bascom Rope Co., St. Louis, Mo., will show its usual interesting display of wire rope. Included in this year's exhibit, will be its flex-set pre-formed construction. This company began the manufacture of pre-formed rope this summer. The exhibit will be in charge of Fred Zimmerman, Sales Manager. Several salesmen also will probably attend.

Buda to Exhibit Diesel and Three Gasoline Units

The Buda-M. A. N. Industrial Diesel developing 90 H.P. will be one of the main exhibits of The Buda Co., Harvey, Ill. This is a 4-cylinder, high speed, light weight, full Diesel engine and is representative of The Buda Company's line of Diesel engines which range up to 180 H.P.

A Buda H-298 6-cylinder power

unit will also be shown. This is a 7-bearing engine with 3-in. crankshaft. This engine has a wide speed range and develops from 28 to 63 H.P. at speeds from 800 to 1800 R.P.M. The H-298 represents a line of power units which range from 20 to over 100 H.P.

A larger Buda Hivelo model will also be exhibited for the first time in the Model K-393. This is also a 7-bearing engine with 3-in. crankshaft and develops 42 to 90 H.P. at speeds ranging from 800 to 1800 R.P.M.

Buda Model JH-4, 87 H.P. shovel engine will also be shown.

The exhibit in Booth No. 253 will be in charge of R. K. Mangan, Sales Manager, Industrial Division. Other Buda representatives who will attend are: H. M. Sloan, Vice President and General Sales Manager; C. C. Hinkley, Chief Engineer; Walter Parrish, Chief Draftsman; A. F. Ochtman, Sales Engineer; L. F. Shoemaker, Sales Engineer; J. C. Baseheart, Sales Engineer.

Buffalo-Springfield Roller Co. Exhibit

The Buffalo-Springfield Roller Co., Springfield, O., will exhibit the smallest and largest Buffalo-Springfield motor driven tandem rollers and three sizes of Buffalo-Springfield



Buffalo-Springfield Roller to Be Seen at the Show

multiple cylinder motor driven three-wheel rollers ranging in weight from 5 to 10 tons. The exhibit will be in Space 126.

Burch to Show New Spreader

The Burch Corporation, Crestline, O., will exhibit two styles of Ross snow plows and a new type Burch spreader, also a Burch crack filler. The space is Booth No. 219 and the

exhibit will likely be in charge of Mr. E. C. Bishop of Jackson, Mich., while several of the representatives of the firm will be in attendance.

Butler Bin Co.

The Butler Bin Co., Waukesha, Wis., will exhibit a small working model of a three compartment steel storage bin equipped with a weighing hopper with a three beam scale, an automatic bulk cement weighing hopper, the latest type aggregate weighing hopper, bin gates, etc. New literature devoted to bulk cement handling plants of both the automatic and manually operated types, will be ready for distribution. The exhibit will be in charge of M. R. Butler, A. R. Morton and H. W. Butler.

Carey to Exhibit Elastite Products

The Philip Carey Co., Lockland, Cincinnati, O., will exhibit Elastite expansion joint, asphalt plank, rail filler and subgrade felt.

Elastite expansion joint has been used for 20 years on important work throughout the world.

Elastite asphalt plank was first produced by The Philip Carey Co. seven years ago and now widely used as a wearing surface for bridge floors, loading platforms, industrial trucking aisles, and other similar types of service.

Elastite rail filler is an asphalt composition cushion used to absorb vibration and impact in street railway track rails. It is made accurately to fit any rail, and applied between rail and pavement. It is widely used by electric railway companies in the United States and Canada.

Elastite subgrade felt is a light, strong, tough waterproof paper or felt used on subgrade under concrete pavement to prevent absorption of water from fresh concrete, to eliminate sprinkling of subgrade, and to reduce subgrade friction.

The company will be well represented by a number of sales department heads, engineers, and salesmen with C. V. R. Fullenwider, manager, Elastite Products Division, in charge. Exhibit space is No. 106.

J. I. Case Exhibit

J. I. Case Co., Racine, Wis., will exhibit its "CI," "LI" and "C D" industrial tractors, its power mower and its "CE" and "LE" industrial motors. The exhibit will be in Space No. 111. The names of

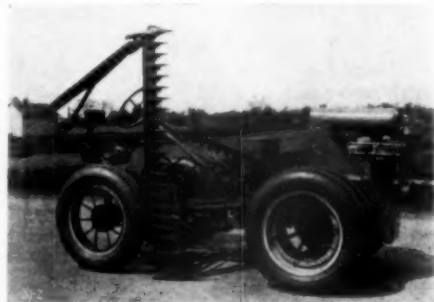


Case Model Tractor

those who will be present at the booth are L. L. Hoaglin, George Iverson, F. F. Hughes, M. R. Comer, W. N. Ballinger, as well as representatives from the engineering and advertising departments at Racine.

Centaur Tractor Corp. to Show Highway Mowers

The Centaur Tractor Corporation, Greenwich, O., will exhibit its Centaur highway mower in Space No. 445. The mower is a complete unit. It is equipped with automatic clutch brake, flexible hitch, foot and hand clutch control, Centaur shoe suspender, perfected vertical lift, knife end guard, two extra cutter knives, tool box with tools, extra knife sec-



Centaur Hi-Way Mower

tions, spring seat. Knife grinder and anti-skid chains are extra equipment. Some details follow: Weight, 2500 lb. Turning radius inside, 5 ft.; outside, 10 ft. Length over all to back of mower seat, 10 ft. Width with cutter bar down, 9 ft. 5 in. Height, 56 ft. at steering wheel. Cutter bar horizontal lift, 12 ft. Width of mower tread, 4 ft. 7 in. Cutter bar, 5 ft. or 6 ft. Width of tractor tread, 3 ft. 6 in.

The motor is a Le Roi twin cylinder equipped with high tension magneto, and Vortex oil air cleaner. Governor control, 600 to 1600 r.p.m. Gasoline tank capacity, 6 gal., stated to be sufficient for 10-hour run. Radiator—at back of engine, with blast of air forward blowing dust, dirt, and heat away from the operator.

Central Iron & Steel Co. to Show Miniature Bridge

The Central Iron & Steel Co., Harrisburg, Pa., will exhibit a miniature bridge equipped with Central "Knobby" non-skid steel traffic treads, stairways and steps. In addition various other products manu-



Exhibit of Central Iron & Steel Co.

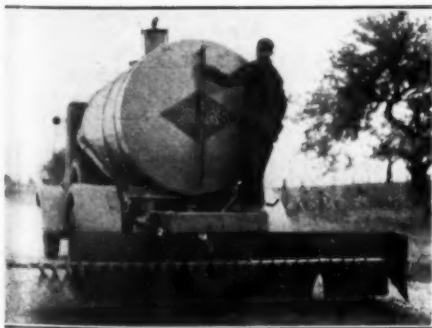
factured by this company will be shown. Robert H. Irons, President, and Frank C. Carter, Assistant General Sales Manager, will be in attendance during the convention.

Cleaver-Brooks Co.

Cleaver-Brooks Co., Milwaukee, Wis., will exhibit a No. 1 bituminous booster on a 2-wheel trailer and a No. 2 bituminous booster on a 1½ ton truck with pumping unit.

Colas Exhibit

Colas Roads, Inc., New York, N. Y., exhibit will display the uses of Colas. The exhibit will demonstrate how the Colas process incorporates asphalt into a road surface. A sample road constructed by the Colas process will be exhibited, also numerous photographs illustrating types of surfaces and of roads being built under various conditions, from arctic to



Applying Colas to a Road Surface

tropical. The exhibit will be in Space 423. Those attending this interesting exhibit will include J. S. Sawyer, General Manager of Colas Roads, Inc., and Messrs. V. L. Osterlander and G. N. Hoffman, New York; L. M. Stanhope, Pennsylvania; F. J. Murray, Chicago; J. Gordon Muir, Ohio.

Colprovia Exhibit

Colprovia Roads, Inc., New York, N. Y., exhibit will consist of motion pictures, photographs and descriptive matter demonstrating the progress and the latest developments in road construction which have been made by their operating companies and themselves. Edmund Johnstone, President; F. C. Armstrong, Vice President, and J. A. Dow will be present at the convention.

Columbia Alkali Co. Exhibit

The Columbia Alkali Co., Barberton, O., will display pictures, samples and literature on calcium chloride in its various road uses, including dust control and maintenance of unpaved roads, concrete curing, and for treatment of icy pavements.

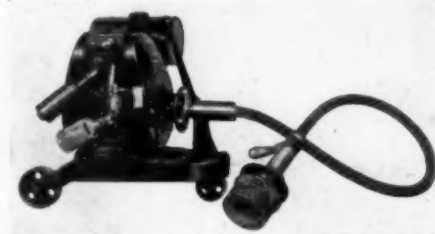
The exhibit will be in Booth No. 141, and the company will be represented by Ray A. Giddings, manager, special products sales, as well as district representatives, including A. H. Gillespie, Birmingham, Mich.; J. R. Bush, Detroit Lakes, Minn.; J. F. Dockum, Indiana; S. S. Warren, Ohio.

Concrete Surfacing Machinery Co. to Show New Surfacers

The Concrete Surfacing Machinery Co., Cincinnati, O., will exhibit the Berg Model "A" concrete sur-

facers and finishers, the Berg Hi-Way surfacer and the Berg Cleaning Tool. In addition to these three machines, the company will also exhibit its new machine—the Berg Heavy Duty Surfacers.

The Berg Heavy Duty Surfacers is made in two models—electric and gas engine. It is intended for use on jobs where the lighter Model "A" is not adaptable and where a longer shaft machine is necessary. The gas model is, of course, for use where electric current is not available. The electric model is equipped with a 110-220 volt, single phase, alternating current motor, which weighs approximately 85 lb. and is mounted on two large wheels. A convenient switch is on top. It develops a speed of 1725 r.p.m. The gas engine model is powered by a 1 hp. air cooled gas engine, mounted on a specially designed steel chassis. The speed ranges from 1500 to 3200 r.p.m. In addition to the cutter plate and carbo disc, furnished with both machines (models), steel wire brushes, flexible disc sander, mandrel buffing attachment, etc., can also be supplied for mounting on tool head. Also, the Berg carbocylinder attachment can be furnished, with a special long shaft, for mounting on the motor end. A 7-ft.



Berg Heavy Duty Surfacers

flexible shaft is standard equipment on both models.

The members of The Concrete Surfacing Machinery Co., who will be in attendance at the show are: M. Wetstein, president; A. Dreifus, F. E. Aurand, Jr., and M. Wolfson.

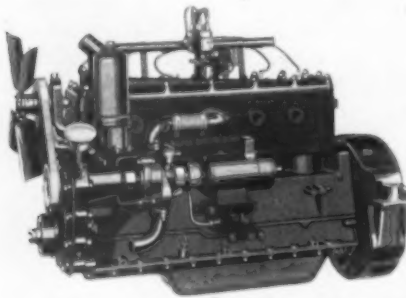
Continental Motors Exhibit

The Continental Motors Corporation, Detroit, Mich., will display the following engines:

Model 22R—6-cylinder 4½ x 5¼, displacing 500 cu. in. This is a new valve-in-head development. Model E601, representative of a new series of L-head truck engines—6-cylinder; 3⅞ x 4½. Model 25A—An engine of the small 6-cylinder class; 3⅞ x 4. Model W10—A 4-cylinder, 200 cu. in. engine with L-head, 3⅞ x 4¼. Model H24—An industrial

engine, representing the series of new valve-in-head industrial engines for heavy duty application. Size $5\frac{3}{4} \times 6\frac{1}{2}$, displacing 675 cu. in.

There also will be shown a model P431 power unit, 4-cylinder $4\frac{1}{8} \times 4\frac{1}{4}$, as well as a model P411, 4-cylinder, $2\frac{3}{4} \times 3\frac{5}{32}$. Both of



Continental E600 Engine

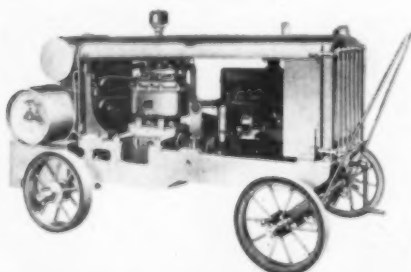
these are recent additions to Continental power unit line. On exhibition, there will also be a model M5 4-cylinder engine in the Pierce Governor Co.'s booth, demonstrating an industrial governor application.

The Diesel engine exhibit will be conducted in the Research Division of the Continental Motors Detroit plant. Arrangements will be made for transportation to and from the show to the Continental exhibit.

The exhibit will be in Space No. 310. Those in attendance at the show will be Ray Long, A. R. Smith, R. J. Middleton, W. N. Fitzgerald, M. H. Schachner, Stuart Nixon and L. E. Arnold of the Sales Division. Dan Andrews of the Machine Products Division and E. T. Vincent of the Diesel Division.

Curtis Pneumatic Mchy. Co. Exhibit

The Curtis Pneumatic Mchy. Co., St. Louis, Mo., will show its portable compressor unit which incorporates the Curtis model "C" carbon-free Timken roller bearing equipped compressor. The line of portables is complete from 40 cu. ft. up to 240 cu. ft. in two- and four-wheel mounting, with either solid or pneumatic tires. The carbon free valve design



Curtis Portable Air Compressor

feature of this compressor is of especial interest. The exhibit will be in Space No. 241 and will be in charge of I. B. Lewis and R. P. Stone.

Diamond Iron Works, Inc., to Feature New Plant

The Diamond Iron Works, Inc., Minneapolis, Minn., will feature its recently designed triple purpose plant. While it is not the intention to actually exhibit the plant a very complete descriptive bulletin on the plant will be distributed.

The plant consists of two units, one a 15x36 in. Diamond Timken roller bearing crusher and a set of 26x20 in. rolls mounted on a chassis, together with a bucket elevator; the other a bin and screen with means to deliver the oversize material from the screen to the crushers, when it is used as a sand and gravel plant. When used in a quarry, the field conveyor going to the screen is eliminated and the rock is dumped directly into a hopper provided on the



New Diamond Crushing and Screening Plant in Operation Near Menomonie, Wis.

15x36 in. crusher. When it is not necessary to crush any of the material, the screening unit itself can be used separately, all oversize material being rejected by a conveyor. The screening unit itself is self-contained, in that it is mounted on a chassis with a 20 hp. motor, and it can be mounted on either steel wheels or rubber tired wheels.

Dodge Planning Special Exhibit

Dodge Brothers Corporation, Detroit, Mich., are planning a large exhibit, which it is reported will contain several special features. The display will contain a full line of trucks and equipment. The exhibit will occupy Booth No. 311 and will be in charge of Allison Miller, George A. Orphal and Herman Ude.

Dow Chemical Co. Exhibit

The 1932 exhibit of The Dow Chemical Co., Midland, Mich., will be larger than ever before and has an unusually interesting display regarding the uses of Dowflake calcium chloride. Particular attention will be given to a demonstration of the advantages in using Dowflake for the treatment of sleet covered roads and streets to insure safe driving. Also for the treatment of stock piles of gravel, the thawing of frozen catch basins, etc., and other interesting features. The use of Dowflake for dust prevention on gravel or similar type roads will be shown as usual. The latest recommendations in regard to curing concrete with calcium chloride will be available. Don Williams, Assistant Sales Manager, will be in charge of the exhibit.

Eisemann Magneto Corporation

The exhibit of the Eisemann Magneto Corporation, New York, N. Y., will consist of a display of its latest improved type of magnetos for engines from one to six cylinders, as well as various adaptations of flywheel magnetos for small single cylinder engines. The exhibit will be in Space No. 208. Those in attendance will be: T. E. Kennedy, General Sales Manager; B. B. Woodford, Assistant Sales Manager; O. S. Stanley, Chicago Branch Manager; I. W. Edwards, Detroit Branch Manager; G. W. Kuehn, Chief Engineer.

Euclid Road Machinery Co.

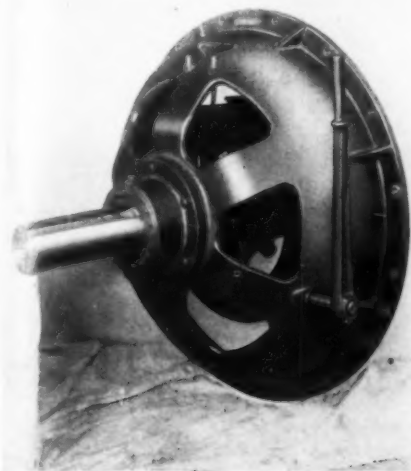
Euclid Road Machinery Co., Cleveland, O., will display its Euclid trackwheel, bottom dump wagons, Euclid bulldozers, Euclid wheel scrapers, Euclid rotary scrapers, Euclid tampers, and the Euclid advance design trackwheel.

Fairbanks-Morse to Exhibit Aggregate Scales

Fairbanks-Morse & Co., Chicago, Ill., exhibit will consist principally of concrete aggregate scales which have been designed to permit the exact weighing of all aggregates used in concrete construction. Separate beams are provided for each of the aggregates and by pushing a button they may be engaged in order so that they weigh any chosen aggregate. An over and under indicator tells when the proper amount is in the wheelbarrow on the scale platform.

Fawick Mfg. Co. to Show Clutches and Power Take-Off Units

The Fawick Manufacturing Co., Waukesha, Wis., will have on display a complete line of heavy-duty expanding shoe clutches from 9 in. to 20 in. diameter, and its complete line of power-take-off units from the No. 3 to the No. 00 SAE housing sizes. In addition to this, it will have a display unit consisting of a road roller transmission on which



Fawick Housing with 20-In. Clutch

will be mounted a pair of its recently developed fully-enclosed nonadjustable reversing clutches designed specifically for road roller application. This latter exhibit will be motor-driven so that the operation of the clutches can be demonstrated.

Thomas L. Fawick, President, and C. M. Eason, Secretary and Treasurer, will be in attendance.

Federal Motor Truck Co. to Exhibit Four New Models

The Federal Motor Truck Co., Detroit, Mich., will exhibit four new models: Model C-8, 5-6 ton truck; Model E3, 1½-ton dump truck and hoist; Model E2D, 2½-3 ton chassis and cab, 6-wheeler; Model T10D.R. with dump body and hoist.

The heavy-duty 5-6 ton Federal,

designed for hard, cross-country service and for heavy loads to be hauled long distances at sustained high speed, is available with Westinghouse air brakes or hydraulic brakes (with vacuum booster) on four wheels. It is furnished in eight wheelbases: 153-in., 165-in., 177-in., 185-in., 195-in., 213-in., 231-in. and 249-in.

Heavier construction and greater power are stressed in all features which include extra-heavy, full-floating rear axle with a new high traction differential (worm or double reduction type), 14-in. clutch; multi-speed transmission with over-drive; extra heavy frame with fish plates having a maximum depth of 14½ in.—Federal patented Reservoir lubrication; heavier springs and large six-cylinder engine with dual ignition. The full-floating rear axle of the worm or double reduction type with the new high-traction differential is an outstanding feature. Power is transmitted to the driving wheels in proportion to their traction, so that any loss of traction in one wheel is automatically offset by added power applied to the free wheel.

The exhibit will be in Space 304, and the following members of the Federal organization will be in attendance: W. B. Rayburn, manager, national sales division; F. T. Wright, national sales representative, Chicago; Jack McCarty, special representative, Washington, D. C.; O. C. Dunham, public works division; M. F. Hart, public works division; H. T. Swain, district sales manager; Earl Winans, equipment engineer; F. P. Soper, sales manager.

FWD to Exhibit New Truck

The Four Wheel Drive Sales Co. of Clintonville, Wis., will exhibit two FWD trucks. Their exhibit will be located in the Municipal Airport Building at Space 211. The models to be shown will be a new and more powerful HH6 of 2½ tons and the 1932 6-wheeler job of six tons capacity.

The HH6 is a new job featured especially as a road building and maintaining machine. It will be



The HH6, a New Truck of the Four Wheel Drive Auto Co.

equipped with a dump body and hoist, also the latest type power controlled underbody scraper. A powerful motor developing 85 brake horsepower is hooked up to all four wheels through a seven speed transmission.

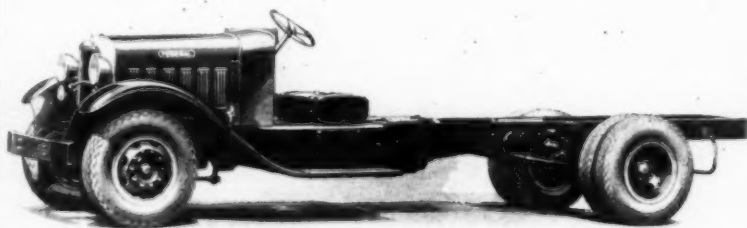
The X6 model is a four wheel drive 6-wheeler employing the regular FWD drive; that is, a live front axle and first rear axle with a dead second rear axle. This new truck is greatly improved in appearance over former models and has a number of mechanical improvements as well. The motor and transmission have been lowered considerably making an almost straight line drive between the transfer case and two driving axles. Motor power has been increased with heavier units incorporated all along the driving line. Balloon tires of the 10.50-20 size will be used on all six wheels. The low mounted coupe type cab is completely equipped with all the comforts of a pleasure car including a unit instrument panel indirectly lighted.

The following members of the FWD organization will be in attendance at the Road Show. W. A. Olen, President and General Manager, R. H. Schmidt, General Sales Manager, S. H. Sanford, Assistant Sales Manager, W. M. Hanson, Advertising Manager, H. M. Daniels, Branch Manager, New York City, and H. G. Engel, District Sales Manager.

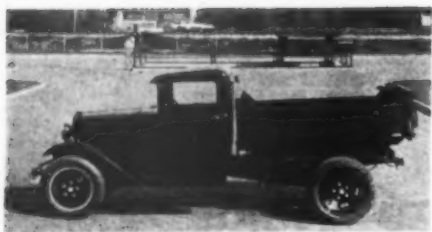
In addition to the FWD trucks exhibited by the Four Wheel Drive Sales Company there will be another interesting FWD at the show. A hydraulic controlled Wausau snow plow is being exhibited by the Wausau Iron Works on the 7½-ton M7 model.

Ford Motor Co. Exhibit

The Ford Motor Co., Dearborn, Mich., will exhibit a 157-in. stake body, a 131½-in. heavy duty hydraulic dump body, a highway personnel car, a Model "AA" cutaway



New Federal 5-6 Ton Truck



Ford Heavy Duty Hydraulic Dump Body

chassis, a station wagon and a Fordson tractor. The location of the exhibit is in Space No. 213.

Fruehauf Trailer Co. Exhibit

The Fruehauf Trailer Co., Detroit, Mich., will exhibit its Type G Carryall. It also will exhibit a Fruehauf Flyer—Model C-961—3 to 5-ton capacity; Model B-374—Fruehauf automatic semi-trailer chassis; a round front end drop frame van semi-trailer and a 4-wheeler equipped with a milk tank. The carryall, which is the main exhibit, has a 45-ton rated capacity and has 8 wheels in the rear with 2 wheels on the front truck equipped with dual solid tires. The exhibit will be in Booth No. 258.

Fuller Co. to Show Bulk Cement Pump

Fuller Co., Catasauqua, Pa., will exhibit a portable Fuller-Kinyon pump, a Fuller rotary air compressor and its rotary valve for cement withdrawal control from bins. The exhibit will be in Booth No. 130, and the following will be in attendance: P. F. Stauffer, Sales Manager; J. M. Alonso, Manager, Fuller Company Chicago Office; G. K. Engelhart, A. E. Douglass, President, and J. W. Fuller, IV will be present for part of the time only. The booth will be in charge of Mr. Engelhart.

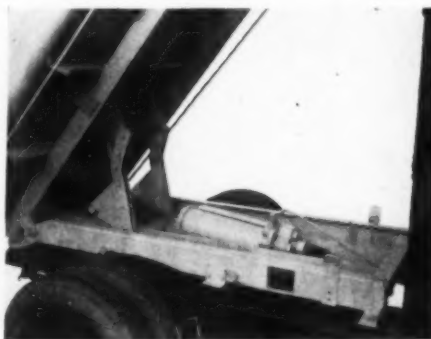


Fuller-Kinyon Pump for Unloading Bulk Cement and Asphalt Filler

Galion Allsteel Body Co. to Show Its Latest Hoist

The Galion Allsteel Body Co., Galion, O., will exhibit three of its latest hydraulic hoists, two of which will be equipped with bodies. One of the latest models—GH-56 is illustrated herewith. Among its outstanding features are the equalizing lift links, self aligning bearing of the drive shaft, oil governor to prevent over loading of the hydraulic system, elimination of all screwed connections, automatic locking of body in any position and a one unit type sub-frame construction.

The exhibit will be in Booth 242. G. L. Stiefel, President, and B. J.



Model GH-56 Heavy Duty Galion Hydraulic Hoist

Heiser, Manager of Sales, will be in attendance.

Geneva Metal Wheel Co.

The Geneva Metal Wheel Co., Geneva, O., will have a display of steel and rubber tired wheels, steel axles and roller bearings. In addition to these regular items the company developed a new high-grade traffic marker which will be on display. This marker is known as Geneva "Twin-Pin" traffic marker.

The exhibit will be in Space No. 257-A. H. A. Carter, R. C. Patterson, R. E. Sawyer and A. C. Morley will represent the company.

Gledhill to Show New Grader

The Gledhill Road Machinery Co. of Galion, O., will display one of their new Graders in Booth No. 212, at which time an announcement of their new graders in Booth No. new line has been in process of development for more than a year past under the direction of E. C. Gledhill. The new plant of the Gledhill Road Machinery Co., is now nearing completion and their graders will be in production there within a few weeks. Their road adjuster announced early last fall for use with road graders also will be produced in the new plant.

Goroco Mechanical Spreader Exhibit

The Goroco Mechanical Spreader Co., Upper Darby Postoffice, Phila-



The Goroco Mechanical Spreader

delphia, Pa., will again exhibit its separate spreading unit for covering oiled surfaces, icy pavements and other uses requiring the spread of loose aggregates in quantities up to 50 lb. per sq. yd. The machine shown will be the same model displayed at the show last year.

The Goroco operates on the principle of centrifugal spread, making it possible to spread variable widths, regulated by the speed of the truck. The quantity spread is regulated by a multiple slide gate opening in the hopper controlled by a lever within easy reach of the operator. This opening is always self-centered over the spreading disc, assuring uniform distribution at all times. The model illustrated will be shown together with a working model and moving pictures.

The exhibit will be in Booth No. 403. R. E. Eggleston will be in charge of the exhibit, assisted by A. I. Dean and H. N. Bechtel.

Haiss Exhibit

George Haiss Mfg. Co., Inc., New York, will not exhibit any machinery, confining itself to moving pictures and literature. The exhibit will be in Space No. 137. W. H. Bosworth, Sales Manager, and D. H. Fair, Middle Western Manager, will be in attendance.

Hauck Mfg. Co. to Show Asphalt Emulsion Sprayer

Hauck Manufacturing Co., Brooklyn, N. Y., will exhibit a fuel oil burning asphalt surface heater and asphalt kettle and an asphalt emulsion sprayer, besides a small portable torch and weed burner; also oil burners for asphalt plants. The newest thing in the exhibit will be the asphalt emulsion sprayer. These cold tar and emulsion sprayers are made in hand and power operated



Hauck Power Emulsion Sprayer on Park Road Repair Job

models. The latter is furnished in the pressure pump and gear pump types. The illustration shows a power sprayer in use on a park road repair job. The pressure pump type is furnished with a 1/2-hp. combination gas engine compressor unit which generates pressures in the 60-gal. tank (equipped with pressure gage and safety valve) and forces the asphalt emulsion to the spray nozzle. Before leaving the tank, the asphalt emulsion passes through a basket strainer (eliminates clogging) into the 25 ft. of emulsion hose and to the 6-ft. spray bar, which is equipped with a special rotary spray nozzle and a spring trigger valve to control or instantly stop the flow of the material. The chassis is of 3-in. channel iron. Overall length 9 ft.; overall width (axle ends) 35 in.

In the gear pump type, which is used mainly for curing green cement pavements, foundations, etc., waterproofing, etc., the material is automatically agitated and then pumped at a pressure of about 45 lb. from the shipping drum to the spray bar where it is atomized by compressed air at about 60 lb. pressure through a special rotary spray. These sprayers are equipped with a 3 hp. combination air-cooled gas engine compressor unit, which also operates a geared suction pump. A pressure chamber eliminates all pulsations in the air line. A pressure relief valve is provided to maintain an even pressure on the liquid. The exhibit will be in Space No. 312 and in attendance will be: F. John Schwenk, Sales Manager; Herber Vogelsang, Cleveland District Manager; Jules Escherman, Chicago District Manager.

Hazard Wire Pipe Co. Exhibit

The Hazard Wire Rope Co., New York, N. Y., will show all types of wire rope products made by Hazard but will feature lay-set preformed wire rope. It will also have on ex-

hibit its guard rail cable. The exhibit will be in Booth No. 145, in charge of W. H. Slinghuff, District Manager at Chicago.

Hercules Motors to Display Entire Line of 4 and 6-Cylinder Engines

The Hercules Motors Corporation of Canton, O., will have in Space 300, a complete display of their entire line of modern heavy-duty 4 and 6-cylinder engines, ranging in size from 9 to 175 hp.

This year the exhibit will particularly feature a large series of heavy-duty 6-cylinder engines known as the "HX" series, including five models with the following bores and strokes: HXA 4 3/4 x 6-in., HXB 5 x 6-in., HXC 5 1/4 x 6-in., HXD 5 1/2 x 6-in., HXE 5 3/4 x 6-in.

The "JX," a series of small heavy-duty 6-cylinder engines of three models, including the following bores and strokes: JXA 3 3/8 x 4 1/4-in., JXB 3 5/8 x 4 1/4-in., JXC 3 3/4 x 4 1/4-in.

The "IX," a small series of heavy-duty 4-cylinder engines of three models, including the following bores and strokes: IX 2 1/2 x 4-in., IXA 3 x 4-in., IXB 3 1/4 x 4-in.

Both engines and power units will be displayed.

In addition to the above the Hercules Motors Corporation will exhibit models of the well known "TX" series, "OO" series, "L" series and "OX" series of 4-cylinder heavy-duty engines and power units and the "WX" series and "YX" series of heavy duty 6-cylinder engines. Also, a complete exhibit of parts will be on hand.

Hercules Products to Show Dump Bodies and Engines

Hercules Products, Inc., Evansville, Ind., will exhibit in Booth 416 an assortment of Hercules all steel dump bodies and in Booth 235 an assortment of Hercules gas engines.

The line of dump bodies will consist of mechanical power, hydraulic power, rotary power, automatic and hand hoist bodies in various styles and capacities. The line of gas engines will consist of 1 1/2-2 hp., 2 1/2-3 1/2 hp., 6 hp. and 8 hp. engines that can be run on either gasoline, kerosene or distillate fuel. The exhibit will feature the hydraulic power dump bodies in the straight side, coal and coke flared side, removable side and garbage types.

It is expected the following will attend: G. K. Specht, Vice President (Distribution); B. E. Karges, Sales Promotion Manager; R. L. Frazier, Service Manager; O. H. Ol-



Hercules 1 1/2 Cu. Yd. Straight Side Hydraulic Power Dump Body

sen, Regional Manager; E. P. Monroe, Manager Dump Body Division.

Highway Service to Exhibit Spreaders

Highway Service, Inc., New Bedford, Mass., will show its "Handy Sandy" spreader and its "Handy Rol-Roc" spreader. The last mentioned is a development of the same roll and brush principle as used in the Handy Sandy. The machine is used for spreading a uniform layer of rock. The spreading principle is simple in the extreme: A revolving roll which travels on the spread stone running the entire length of the machine and a steel wire brush to regulate the depth of material spread. This is stated to allow the spreading of mixed sizes of stone without any tendency to segregate—the larger pieces making their own opening through the regulating brush. Furthermore, the depth of spread is not governed by the height of the machine above the ground so that in case of running over manholes as in



Handy "Rol-Roc"

city work, or large stones as in speeding mixed material, the depth of spread is not materially affected. Attachment is made by two chains to any convenient part of the truck, and the machine may be operated by one man only.

The exhibit will be in Booth No. 121. W. G. Ramsden and Ralph I. Stitt will be representatives.

Huber to Show New Maintainer

The Huber Manufacturing Co., Marion, O., will exhibit in Space No. 129 a 10-ton motor roller, a 5-ton motor roller and a Huber maintainer.

The motor rollers will be the standard rollers. The Huber maintainer, which was developed in an improved form last year, will be shown at a public exhibit for the first time. Many new features are incorporated in this unit. It is powered by a Huber modern industrial power plant and may be either 4 or 6-cyl-



Huber Maintainer

der at the purchaser's option.

M. E. Miller, sales director, will be in charge of the exhibit, assisted by J. H. Cooper, manager of the Huber branch at Indianapolis, Ind., and by W. J. Maloney, New York State sales representative.

Hug Company to Have Complete Exhibit

The Hug Company, Highland, Ill., will have a complete exhibit of its roadbuilding trucks and equipment. The exhibit will be located in Booth No. 226 and will be in charge of R. K. Tibbetts, General Manager.

Two standard model Roadbuilder Trucks, Models 60 and 82 will be on exhibit and in addition, the company will exhibit for the first time the new Hug agitator body, a body designed especially for the transportation of wet concrete and which will be mounted on an 87K Hug Roadbuilder chassis.

The Hug agitator body consists of an open top, cylindrical steel tank or body, the inside walls being perfectly



New Hug Agitator Body

smooth. The body is not a revolving type body but can be raised or lowered by means of a power hoist. The agitation of the concrete is effected by four spring blades, these blades being attached to a shaft that runs through the center of the body, the shaft rotating four spring blades through the concrete. The power used to drive the spring blade agitator is furnished by a 3-hp. independent motor attached to the side of the body.

The Hug agitator body is furnished in 2 and 3 cu. yd. capacities. The 3 cu. yd. body weighs less than 3000 lb. The body is also equipped with a special discharge gate making it possible to discharge a partial load of any desired quantity. The discharge gate is water-tight and by the operation of a simple lever the amount of the concrete discharged can be increased or decreased and immediately cut off.

In addition to the Roadbuilder trucks, the Hug Company will also exhibit standard models of the subgrading machine and subgrade template.

Chas. Hvass & Co., Inc.

Chas. Hvass & Co., Inc., New York, N. Y., will exhibit the following equipment:

Hvass bituminous distributor on motor truck, Hvass junior bituminous distributor on motor truck, Hvass trailer supply tank—1,000 gal. capacity, Hvass spreader attachment for large dump trucks, Hvass spreader attachments for Ford and Chevrolet trucks.



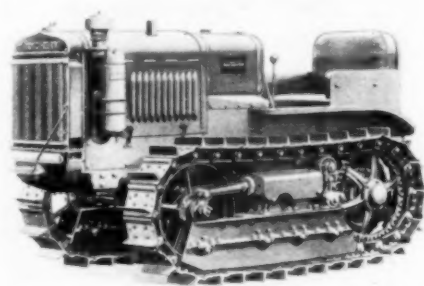
Hvass Junior Distributor

The exhibit will be Space No. 124. Chas. T. Hvass, President, and B. E. Priddy, Secretary-Treasurer, will be in attendance.

International Harvester to Show New Tractor and New Truck

The exhibit of the International Harvester Co., Chicago, Ill., will consist of a new Model T-20 TracTracTor, a sectional model of a Model 20 McCormick-Deering industrial tractor, a sectional model of an A-5 3-ton International motor truck and a new Model A-8 5-ton dump truck.

The new Model T-20 TracTracTor is a compactly and ruggedly-built crawler tractor. The bearings of the drive gear and pinion shaft are provided with specially developed diaphragm-type oil seals, and the track rollers and idler bearings are also protected with oil seals of new design. Efficiency of operation is enhanced by the use of 40 ball bearings, seven of which are in the engine. The transmission and final drive parts are mounted entirely on ball bearings. Like the other McCormick-



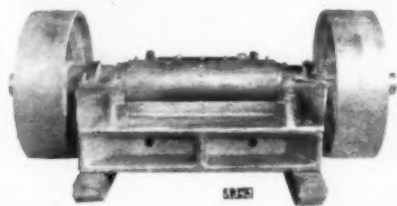
Model T-20 TracTracTor

Deering tractors, the new crawler is of the triple-power type in that it provides power at the belt and drawbar and also through power take-off for operation of auxiliary equipment. The large, positive-acting, single-plate steering clutches, a new feature, are located in the rear compartment of the rear frame. The steering clutch brakes are immediately to the rear of the clutches. Accessibility of working parts, easy removal of such units as the clutch, transmission, steering clutch brake, etc., for inspection and replacement, and removable cylinders are also worthy of special note. Kerosene may be successfully used no matter whether the tractor is working on the level, on sides of hills, or up and down steep slopes. The tractor operates at three forward speeds, respectively $1\frac{1}{4}$, $2\frac{3}{4}$, and $3\frac{3}{4}$ miles an hour, and at 2 miles reverse. The tread width is $41\frac{1}{2}$ in.; track ground contact (length), $52\frac{1}{2}$ in.; width overall, 55 in., and height of radiator, 55 in.

Iowa Mfg. Co. to Show New Crusher

The Iowa Manufacturing Co., Cedar Rapids, Ia., will show its new 3x36 heavy duty reduction crusher. This is a heavy duty reduction crusher for use in both the stationary and portable field. It is designed for the production of unusually large capacity of 3/4-in. and finer road aggregate, and is characterized by its rugged construction and durability features. The company also will show its 14-in. x 36-in. primary breaker crusher, which is also a heavy duty weighing around 23,000 lb. Unusually large eccentric shaft and bearings are used in this crusher to insure against bearing difficulties, as well as alloy steel wearing parts, manganese jaws and key plates, and electric steel castings throughout. Both crushers have special chrome nickel heat treated S. A. E. 3135 eccentric shafts and phosphor bronze bearings cast centrifugally, insuring against porosity.

The exhibit will be in Booth No. 227. Those in attendance will be



New Heavy Duty Reduction Crusher

Howard Hall, president; Kenneth Lindsay, vice-president and general sales manager; A. C. Gossard, assistant sales manager; J. D. Aldrich, district sales manager; and from our eastern branch office, located at Cambridge, Mass., will come H. F. Saxton, manager, and B. P. Saxton.

Johns-Manville Exhibit

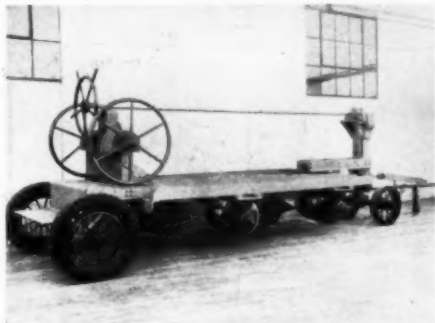
The exhibit of Johns-Manville Corporation, New York, N. Y., will feature J-M Asphalt expansion joints, J-M asphalt bridge planking, J-M celite (an admixture for concrete), and a new commodity just being introduced—J-M transite pipe. The latter pipe is being released after being strenuously tested in J-M laboratories for over a year. It has been used successfully for many years in Europe, particularly in Italy. It is made of asbestos fibres and portland cement, and has a great variety of uses. In the Road Show, it will be featured for drainage and culvert purposes.

The exhibit will be in Booth No.

415 and will be in charge of H. L. Rogers of the New York Office. Also in attendance will be J. B. Jacobs of the Chicago Office, and George Conahey of the New York Office.

Killefer Manufacturing Corp.

Killefer Manufacturing Corporation, Los Angeles, Calif., will exhibit the Killefer road disc for removing



Killefer Road Disc

asphalt macadam corduroy; 9-point grade scarifier; 50-cu. ft. wheeled scraper; 27-cu. ft. revolving scraper for 20-hp. tractors; 64 cu. ft. revolving scraper for 60 hp. tractors; No. 10A Killefer road ripper; No. 25 ditching machine. The exhibit will be in Space No. 122, and the members of the organization who will be in attendance are: O. P. Robb, Vice President and General Sales Manager; C. G. Wuthrich, Columbus, O.; W. L. Franks, Cedar Rapids, Ia.; L. H. Knittel, Philadelphia, Pa.; H. W. Scharber, Atlanta, Ga.; A. P. Olinger, Wichita, Kans.; E. F. Carlmark, Los Angeles, Cal.

Kinney to Exhibit Distributor

The Kinney Manufacturing Co., Boston, Mass., will exhibit in Space No. 128, Section G, one of the latest models of the Kinney super distributor equipments completely mounted on a truck. This distributor equipment is of the separate engine driven type with the gear reduction and clutch assembled as an integral part of the engine. The engine is the well known Continental Red Seal engine equipped with four distinct throttle settings to meet the various requirements.

The pump used is the latest improved type of Kinney pump built especially for this type of equipment, and through the governor control of the engine the various capacities can be obtained up to a maximum capacity of over 400 gal. per minute.

An improved circulating and agitating system is incorporated in this new machine, circulating the hot material when on hot application

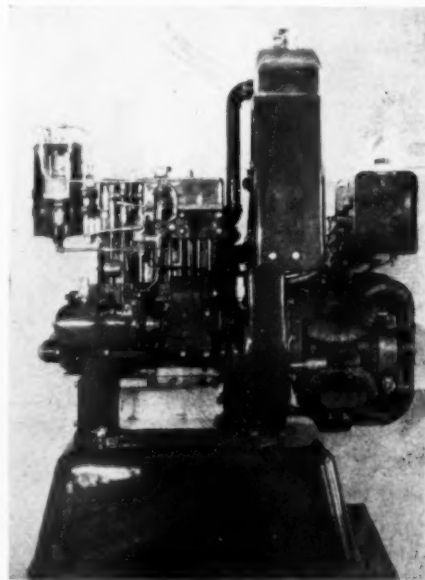
within a few inches of the nozzles. The liberal circulating system insures the material being kept in its chemical entirety, preventing the separation of the volatile oils from the heavy bitumen.

The shape of the tank is oval, and a new heating system is used having sectional immediate control. The heating system is stated to be such as to extract the maximum B.t.u.'s from the hot gases where intense heat is required, and through the sectional control the lighter materials can be heated with the same efficiency and safety. This heating system also provides for heating a small amount of material in the tank when necessary without injury to the tank or material being heated. The increased capacity of this unit is stated to permit of applying under proper pressures widths up to 20 ft.

The exhibit will be in charge of A. J. Munday, with W. E. Worcester, E. F. Bender, H. G. Saunders, Don Neal and Claude Hill in attendance.

Kohler Has Cutaway Plant to Show

Kohler Co., Kohler, Wis., will exhibit a special cutaway model showing the construction and operation of Kohler electric plants. In this special display plant there have been cut away sections of the vacuum tank shell, gear cover, cylinder head, cylinder block, governor housing, generator housing and oil base, exposing effectively the direct-connected generator, the large crankshaft and connecting rods and the compactness and durability of design. A light illuminates the interior of the oil



Special Cutaway Model of 1½ and 2-Kw. Electric Plants

base of the cutaway unit and a small motor is used to operate the plant slowly.

A model EH Kohler that carries its house with it also will be displayed at the 1932 Road Show. Bart Downey, manager of the Detroit branch of the Kohler Company, will be in charge of the exhibit.

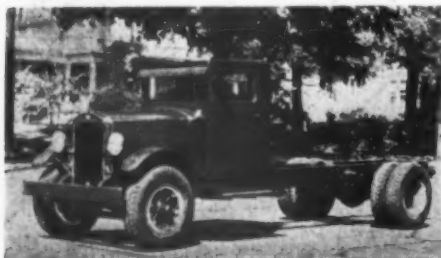
Koppers Products Co. Exhibit

The exhibit of Koppers Products Co., Pittsburgh, Pa., will consist of educational material on the various uses of Tarmac for highway construction, maintenance and repair. The exhibit will be in Booth No. 109. P. L. Griffiths, vice-president, and S. H. Scott, of the Tarmac Department, will be in charge.

La France-Republic Exhibit

The La France-Republic Sales Corporation, Alma, Mich., will display its Model M-3 and Model 35-3 trucks. The Model M-3 has a 22,000-lb. straight rating capacity. Some of the prominent features of this truck are: Waukesha 6-cylinder, heavy-duty motor; Timken double reduction or worm drive axle; 5 speeds forward, 2 reverse; heavy truck transmission; oversize 4-wheel Lockheed hydraulic brakes with oversize B.K. booster; long, wide springs with helper spring on rear; floating contact rear spring installation, eliminating shackles, bushing and pin wear and necessity of frequent lubrication; large diameter ball and socket tubular radius rods; spicer sealed universal joint; straight full depth frame from rear of front spring rear hanger to extreme rear of frame, liberally cross braced and gusseted—no weak frame section over rear axle where strength is required; all side rails fish plated; Dayton cast wheels are standard, ventilated type; alloy iron cast brake drums, all four wheels, and Tru-Stop driveshaft brake.

The exhibit will be in Space No. 224. F. D. Soper, vice-president, and Harry A. Smith, sales manager, will be in attendance. Also F. W. Goodes and A. J. Shorey.



La France-Republic Model M-3 Truck

Lakewood to Show New Form Tamper

The Lakewood Engineering Co., Cleveland, O., will exhibit its complete line of Lakewood paving



Lakewood Form Tamper

equipment, including the finishing machines, subgrader, forms, grade-roots, straight edges, float bridges, etc. A new item that will be exhibited this year is the Lakewood form tamper. This is a tool recently developed to take care of the tamping required under forms, doing the work by machine with a saving of labor and better tamping. It is a small easily portable unit that can be handled by one man, and which will run on the forms once started without further attention until stopped. It is adjustable as to base of form and height and is provided with a tamper operating on both sides of the form at the base.

The exhibit will be in Space No. 220 and will be in charge of Lion Gardiner, president, and R. W. Cornelisen, assistant sales manager.

A. Leschen & Sons Rope Co. Exhibit

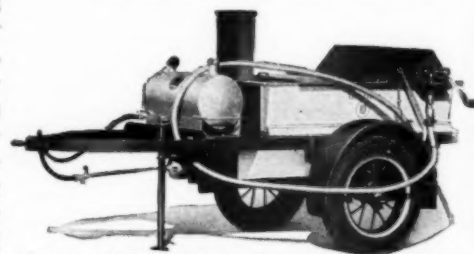
The exhibit of A. Leschen & Sons Rope Co., St. Louis, Mo., will consist principally of samples of its entire line of wire ropes used by the road building industry. These samples will, of course, be mostly of the "Hercules" (Red-Strand) wire rope which the company manufactures in both round strand constructions and patent flattened strand constructions. The exhibit will be in Booth No. 309 with the following in attendance: E. J. Schillinger, E. E. Hickok, Wm. Berninger.

Libbey Cataphote Corp.

The Libbey Cataphote Corporation, Toledo, O., will exhibit Cataphote signs, Cataphote signals, and Cataphotes.

A Surprise Awaits You at the Littleford Booth

Littleford Bros., Cincinnati, O., will occupy booth No. 114. They are to display an entirely new product about which they refuse to divulge any information. Sales Manager Larry Glaser promises, however, that you will not be disappointed if you visit their booth. In addition to the new product, there will be the usual display of LB road maintenance equipment including asphalt kettles, tool boxes, surface heaters, emulsion sprayers, hand torches and joint fillers. The Littleford delegation will be headed by L. W. Glaser, Sales Manager; with Herbert Haupt, Engineer; J. J. Strobel, sales; H. F. Reynolds, sales; L. L. Bradshaw, Engineer—all from



No. 84-HD Asphalt Kettle with Double Heat Circulation

Cincinnati. H. M. Orschel will represent the Littleford Chicago district office.

Lufkin to Exhibit New Tape-Rule

The Lufkin Rule Co., Saginaw, Mich., will have an exhibit displaying and demonstrating all kinds of metal and woven tapes for general measuring requirements, engineering and road building; also a complete line of rules and precision tools.

The "Crescent" tape-rule is the one item that is new since the last convention. It is an extremely useful 6-ft. steel measure, with blade especially formed to make it stand unsupported at any angle for taking "straight" measurements, yet at the same time it will conform to curved and irregular shapes when occasion demands. The markings stand out in sharp color contrast against the body



Crescent Tape-Rule

of the rule, and an unusual type of hook at first end permits accurate measurements when blade is butted against an object, or when clip is hooked over the object. The case, which is compact and durable, is chromium-plated, and completely encloses the blade to exclude dust and dirt.

The location at the show is Section "G," Booth No. 148. R. M. Benjamin will be in charge.

Motor Improvements to Show New Filters

Motor Improvements, Inc., Newark, N. J., will show a complete line of its new metal edge filters, also working demonstrators which show the filter in actual operation. The show space will be No. 410 and the exhibit will be in charge of Frank P. Herman, Neal Vosler and H. B. Graham. All of the above mentioned are resident members of the Detroit office, located at 729 Fisher Building, Detroit, Mich.

National Carbide Sales Corporation

The main display feature of the National Carbide Sales Corporation, New York, will be its large type V-G light. This light has been improved recently to produce 8,000 candle power for 12 hours in a 7-lb. charge of National 14 N. D. (granulated) carbide. The company also will display its national carbide "In the Red Drum."

Exhibit will be in Booth No. 460 and will be in charge of R. C. Holcomb, Service Manager, also E. C. Ackerman, Western Sales Manager, Chicago, and local sales force, Detroit.

National Paving Brick Mfrs. Association Exhibit

The National Paving Brick Manufacturers Association will occupy Booth No. 104 in Section G. There will be moving pictures and models of brick pavement construction, samples of paving brick of various types and literature on the use of vitrified brick as a paving material for distribution. A staff of engineers will be at the booth at all times to answer inquiries and offer advice on the proper design and construction of vitrified brick pavements. The association will be represented by the following: G. F. Schlesinger, Chief Engineer and Managing Director; F. B. Dunn, Assistant to the President; Q. A. Campbell, Assistant Chief Engineer; Wm. C. Perkins,

Chief Engineer, Eastern Region; Jos. Entwistle, Chairman of the Indiana Region; Jas. R. Marker, Chief Engineer, Ohio Region; P. E. Sundstrom, District Engineer, Illinois Region; J. F. Coleman, Chief Engineer, Southern Region; J. C. Gunnell, District Engineer, State of Michigan.

National Traffic Guard Co. to Show Guard Rail

The exhibit of the National Traffic Guard Co., Atlanta, Ga., will include full size portion of guard rail as used along the highways, and will also include miniature models showing its operation and how the prod-



Installation of National Traffic Guard Rail

uct keeps vehicles going along their proper course upon the highways.

One of the new features of this guard rail is the increasing the number of leaves in the spring supports from two to three. The manufacturers likewise have increased the strength of the rail materially, and it now has a tensile strength exceeding 60,000 lb.

The exhibit will be Booth No. 405 and will be in charge of W. H. Chalmers, Sales Manager.

Norma-Hoffmann to Feature Protected Bearings

Norma-Hoffmann Bearings Corporation, Stamford, Conn., will exhibit in Booth No. 234 the following material: Samples of its complete range of types of ball, roller and thrust bearings such as they are manufacturing for use in road building machinery. They will feature their various types of protected bearings. The following representatives will be in attendance at the show: O. P. Wilson, Vice-President; H. J. Ritter, Assistant Secretary; D. E. Batesole, Assistant Engineering Manager; M. B. Hawxhurst, Detroit District Manager; T. J. Harley, Chicago District Manager; R. E. Hecker, Cleveland District Manager.

Owen Bucket Co.

Owen Bucket Co., Cleveland, O., will display its line of buckets, which

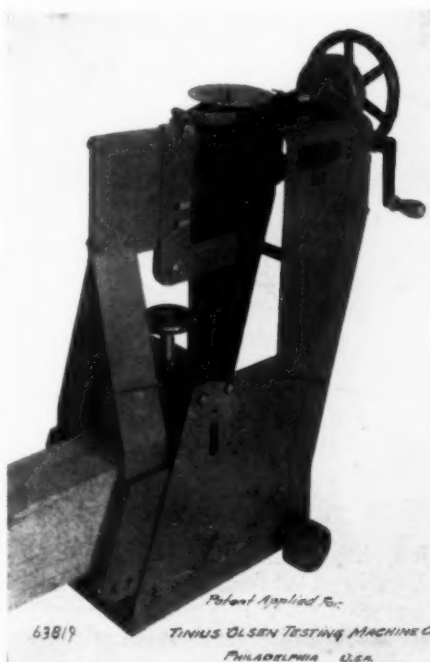
will include all improvements made during the past year. The exhibit will be in Booth No. 236. In attendance at the show will be: H. W. Botten, General Manager; E. W. Botten, Sales Manager; W. E. Phillips, Detroit Manager; E. L. Kelzer, Chicago Manager; W. H. Russell and S. H. Jenkins, from the home office in Cleveland.

Tinius Olsen to Show New Testing Equipment

Tinius Olsen Testing Machine Co., Philadelphia, Pa. will demonstrate considerable new equipment and will show some of its very latest equipment for testing not only cement, concrete and road materials, but also for testing materials used in the construction of road machinery.

For testing cement, it will demonstrate the very latest Olsen automatic shot type of cement tester, having dual weighing system, provided with initial load regulator, and in accordance with latest A. S. T. M. Specifications for Clips. It also will demonstrate for road use, its very latest Olsen concrete beam tester of vertical type. This machine will be demonstrated in connection with the Olsen type of collapsible moulds for preparing specimen.

There also will be demonstrated for the first time, the new Olsen-Andrew road surface rater, of the all-metal type. The other equipment to be shown includes the following: A 20,000 lb. capacity Olsen Universal testing machine with all-lever weighing pendulum dial indicating system; an Olsen Ductility testing



Olsen Concrete Beam Tester

machine of latest No. 20 Hydraulic Motor Driven Type, which will be demonstrated for the first time complete with recording attachment; the very latest Brinell Type of Brinell hardness tester with new rotary power pump supply, and together with this will be demonstrated the Firth Hardometer equipment and the Herbert Pendulum Hardness Test equipment.

In addition to this equipment, there will also be demonstrated the Olsen rubber hardness testing machine for testing the hardness of rubber, the M. I. T. Folding Endurance Paper Tester, and various forms of strain gauges, extensometers, and accessories as used in cement testing. There will also be demonstrated one of the latest Olsen-Lundgren electric spark semi-automatic horizontal cradle type static-dynamic balancing machines, Style "S," for balancing various rotating parts, crankshafts, etc.

The exhibit will occupy Space 402 and will be under the supervision of Harry H. Gildner, Bruce L. Lewis, Thomas Richards, and C. Robert Tait.

Page to Show New Style Guard Rail

The Page Steel & Wire Co., Pittsburgh, Pa., will show in Booth No. 144 Page highway guard and samples of a new style guard rail which it is developing, which will not be placed on the market until later in the spring. The Page Company booth will be in conjunction with those of the American Cable Co. and Hazard Wire Rope Co., who, like the Page Company, are associate companies of the American Chain Co., Bridgeport, Conn. W. H. Blecker, C. N. Johns and S. B. Cairns will be in attendance.

Perfection Steel Body Co. to Show New Hoist

The Perfection Steel Body Co., Galion, O., will exhibit a new heavy duty hydraulic hoist. The company has recently announced the production of this hoist for all 1½-ton, short-wheelbase chassis, with a complete line of steel bodies.

This hoist is presented as a distinctly rugged, heavy duty job, designed and built for over-capacity service. Besides its sturdy construction, the outstanding feature is the "Cushion Drop" mechanism or automatic control which permits dropping the body, either full or empty, very rapidly to the riding position, yet without "slamming" the frame. The

"hydraulic cushion" becomes effective when the body frame comes to within several inches of the chassis, then it eases down to the full riding position. This hoist raises the load to a full 50-degree angle in less than four seconds and returns it by controlled gravity to any intermediate position. An automatic valve mechanism holds the body in any raised position in case the power fails, engine stops, or even if power clutch is released accidentally. The loaded body will also "ride" in any raised position on this hydraulic cushion.

In addition to the hydraulic hoist described above, the Perfection Steel



New Hydraulic Hoist of Perfection Steel Body Co.

Body Co., will display their mechanical hoist.

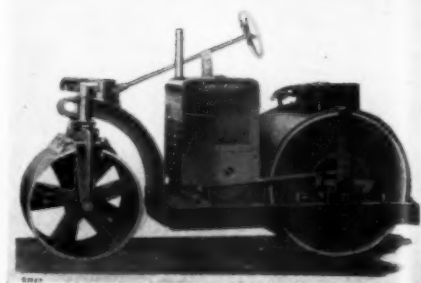
The exhibit will be in Space 444. H. Cohen, President, and Harry Gee, will be the representatives in attendance.

Perfex Corporation Exhibit

Perfex Corporation, Milwaukee, Wis., will have on display heavy duty type radiators, cast aluminum shell, cast iron tanks, sheet metal, and chromium plated pressed steel shell types. They will also exhibit unit heaters, hot water car heaters, and possibly a complete Chrysler "8" Model radiator. Messrs. Wilson and Birdsell will be in attendance.

Pierce Governor Co. to Exhibit Rollers

The Pierce Governor Co., Anderson, Ind., will feature its "Bear Roller," and will have on exhibit one of its Baby Bear Rollers. This is a small power driven roller for lawns, golf greens, parks, tennis courts, school grounds, private estates, etc. It is of the same high grade workmanship as in the heavier rollers. Narrow frame permits



The Bear Roller

rolling within 3 in. of curb. Pull rings front and rear. Adjustable scrapers on front and rear rollers. Rear roller alone weighs 900 lb. The specifications follow:

Motor: Briggs & Stratton, one cylinder, 2¾ x 3¾, air-cooled. Oiling: splash circulation. Ignition: flywheel magneto. Carburetor: Tiltonson. Gasoline capacity: 1 gal., sufficient for five hours. Clutch: cone type. Transmission: sliding gear. Gear shift: one speed forward or reverse. Lubrication: Alemite.

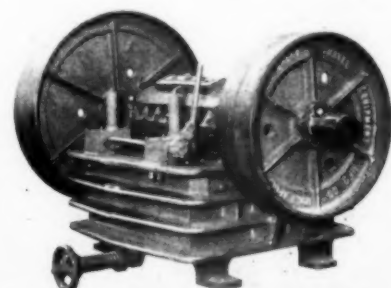
The exhibit will be in Space 101-A.

Pioneer Gravel Equipment Mfg. Co. Exhibit

The Pioneer Gravel Equipment Mfg. Co., Minneapolis, Minn. will exhibit its 1932 Model Pioneer jaw type crusher also a model of the Pioneer No. 12 screening, crushing and loading plant.

The 1932 Model Pioneer jaw crusher has a special oil recirculating system for ring oil side bearings and a special alloy steel in the jaw adjusting wedges. It has the heat-treated, turned, ground, alloy steel eccentric shaft, fully balanced flywheels, a new inclosed jaw adjusting gear box with the parts running in grease and a dust cover over the jaw adjusting wedges.

The Model Plant exhibited weighs 2,000 lb. and is an exact scaled down model of the Pioneer No. 12 plant. Built into it is a miniature jaw crusher, screens, conveyors,



1932 Model Pioneer Jaw Type Crusher

automatic plate type feeder and bucket elevator. This model will screen, crush and load material. C. K. Ordway, J. A. Hanratty, Melvin Ovestrud and K. E. Brunsdale will be in attendance.

Pneu-Hydro Road Machinery Co. Exhibit

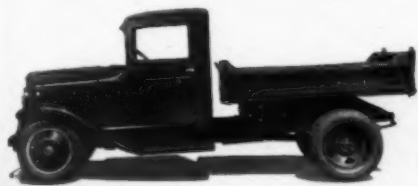
The Pneu-Hydro Road Machinery Co., Cadillac, Mich. will show a new snow blade attachment which they are bringing out this year, and also a 8 to 9 ft. reversible machine. Exhibit will be in space No. 239 with H. E. Price in charge.

Portland Cement Association

The Portland Cement Association, Chicago, Ill., will show photographs and charts illustrating the use of concrete for highways and city streets. The association has been placing special emphasis on single track concrete pavement as an aid to the farmer in providing all-weather connections to the main highways, and illustrations depicting this feature will be shown. In addition the concrete road map of the United States will be on exhibition. The exhibit will be in Space No. 100. E. M. Fleming, Manager Highway and Municipal Bureau, will be in attendance, and the exhibit will be in charge of W. F. Tempest.

Reo to Show Trucks

Reo Motor Car Co., Lansing, Mich., will exhibit two trucks, the 1½-ton dump and hoist and



Reo 1½ Ton Truck

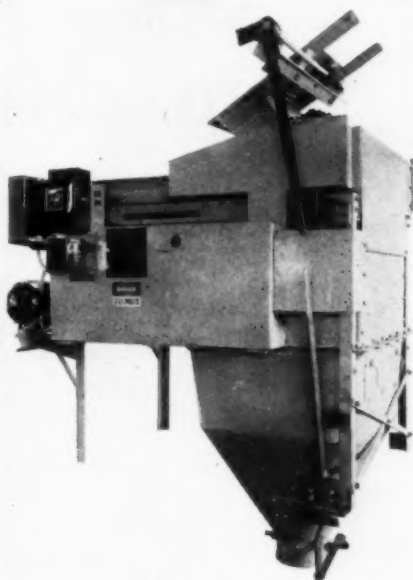
4-ton dump and chassis. Exhibits will be in Booth 245 and will be in charge of W. W. Mitchell of the Speed Wagon Department.

Richardson Scale Co. to Show Bulk Cement Scale

The Richardson Scale Co., Clifton, N. J. will exhibit a 400 to 1000 lb. Model M-39 Richardson duo-screw feed automatic cement scale. This scale will be erected in Booth No. 437 on a special structural steel frame with access stairway and platform to enable all interested parties to look over the scale. The feeding screws will be under power. Thus it will be

possible to demonstrate the operation of the machine approximately as in the field, except, of course, that there will be no material passing through it.

Secretary and Treasurer, H. E. Godfrey and Vice-President and Chief Engineer, S. G. Murray will be in attendance at the show at such time as is convenient to them. The exhibit will be in charge of Wm. F. Cohn, Special Sales Representative and he will be assisted by W. A.



Richardson Model M-39 Cement Scale

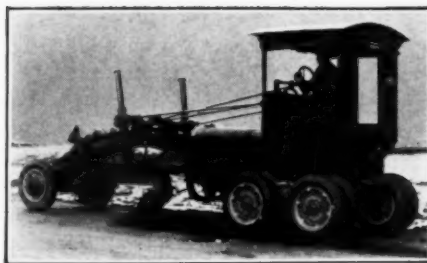
Carte and H. E. Matson, connected with Chicago office. It is expected that the Chicago Office Manager, N. C. Webster will also spend some time at the show.

Relay to Show Two New Trucks

Relay Motors Corporation, Lima, O., will have Space No. 313, and will introduce two new models, showing them for the first time at the Road Show. These will be Models 230 and 240.

Riddell to Show New Equipment

The W. A. Riddell Co., Bucyrus, O., will exhibit an entirely new super-powered oscillating traction unit to which they have given the rather descriptive name of "Octopus" after the deep sea monster with eight long tentacles with a multitude of small digits gripping the bottom of the sea. The Warco octopus has eight pneumatic tired wheels, four on each side and can be furnished with either the standard diamond tread heavy-duty truck type tires or the Goodyear lug type tires. The power of the tractor



The "Octopus"

is transmitted to the wheels through a set of hardened steel gears in a grease tight and dirt proof gear case located between the inner and outer sets of wheels on each side thus exerting equal power to each wheel. The unit is also free to oscillate around the tractor axle which engages the main drive gear of the octopus in the center of the gear case which enables the unit to travel over uneven surfaces affording maximum traction by continued ground contact of the wheels.

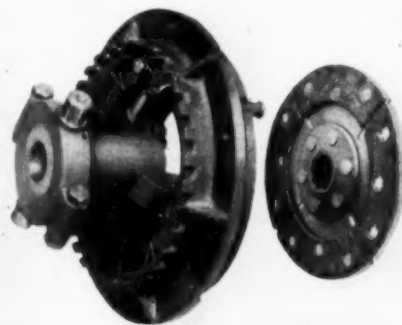
This unit is intended for heavy, fast maintenance or construction work. The octopus is built in two sizes, the smaller to fit the McCormick-Deering Model 20, the J. I. Case Model CI and Allis-Chalmers Model U Tractors while the larger is made for the McCormick-Deering Model 30 and the J. I. Case Model LI tractors.

The W. A. Riddell Company will show the octopus for the first time in their display in Booth 214, Section F.

Rockford Drilling Machine Co. to Show New Clutch

The Rockford Drilling Machine Co., Rockford, Ill., will exhibit a new over center or toggle type clutch. A complete power take-off incorporating a geared reduction also will be exhibited with the Rockford over center clutch installed.

This clutch can be supplied complete with power take-off units of the plain or geared reduction type. Simplicity of construction with less pos-



New Over Center Industrial Clutch

sibility of misadjustment and trouble is paramount in the claims made for this clutch. Other features claimed are as follows: Pressure for the friction drive is directly over the center of the frictional area. Adjustment is made from just one point which is very accessible and permits securing a micrometer variation with ease. The clutch plate used is of a patented construction promoting smooth positive engagement without excessive shock to motor or driven mechanism.

Sizes from 6 in. to 20 in. in diameter can be furnished, with single or double type drive plates, depending on specific requirements and torque capacity of the motors.

E. C. Shields, vice-president of the Rockford Drilling Machine Co., will be in charge of the exhibit, which will be in Booth No. 434, and W. F. Hughes, clutch engineer, will also be in attendance.

Root Spring Scraper Exhibit

The Root Spring Scraper Co., Kalamazoo, Mich., will exhibit a hydraulically operated motor truck maintainer. This machine is fully reversible and is so arranged that a very small amount of pressure per square inch is required to give the maximum pressure on the blade. The



Root Hydraulic Operated Motor Truck Maintainer

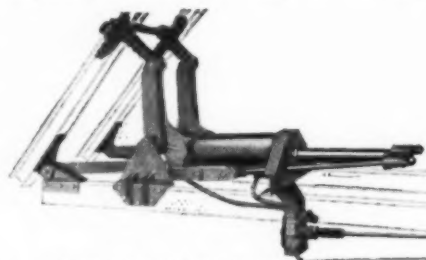
company also will exhibit a miniature of its Big Buster snow plow with hydraulic lift and hydraulically controlled wings. A wing on this plow not only raises vertically by hydraulic pressure but is extended and folded as well. Another feature is the quick change from blade to V and vice versa. By the removing of two bolts, the V can be removed and the blade attached. The same lifting device is used for both plows.

The space number is No. 229. E. A. Weeks, sales manager, and M. J. Root, secretary-manager, will attend the convention.

St. Paul Hydraulic Hoist Exhibit

The St. Paul Hydraulic Hoist Co., St. Paul, Minn., will have a unique and interesting display. Light, medium and heavy duty units of dump

equipment will be on display; however, it will be noted that all are in miniature. The St. Paul line is most complete, there being nine different models of hoists ranging in rated capacity from two tons to 20 tons



Model 95 UB Underbody Hoist

and three different series of bodies to cover the light, medium and heavy duty field. Many recent developments in the entire St. Paul line indicate that the exhibit will be more than interesting and a comparison of these latest models with the first hydraulic hoist manufactured by the St. Paul Hydraulic Hoist Co. will be interesting. Those in attendance at the Booth, No. 302, will be V. L. Farnsworth, Fred Bell, Jr. and Harold H. Miller.

Sauerman Bros. Exhibit

Sauerman Bros. will occupy Booth No. 135, with D. D. Guilfoil, sales manager, in charge. The features of the exhibit will be power-operated models of Sauerman slackline cableway excavator and "Crescent" drag scraper showing the processes of excavating sand and gravel from stream-beds, pits and banks and of stock-piling and rehandling concrete aggregates. A hand-operated model of a crawler crane rigged up with a "Crescent" scraper bucket, illustrates how this hook-up increases the reach of the crane a distance of several hundred feet.

A hand-operated model of an improved type of conveying cableway designed by Sauerman engineers for handling loads of 1 to 20 tons also will be shown.



Sauerman Slackline Cableway Bucket in Dumping Position at Top of Steel Mast. Model of This Machine Will Be Shown at Road Show

In addition to the models, some of the actual equipment will be displayed, including a "Crescent" scraper bucket and several "Duro-lite" steel dragline blocks ranging in size from 6 in. in diameter up to 30 in. in diameter.

Sawyer-Massey, Ltd.

Sawyer-Massey, Ltd., Hamilton, Canada will not exhibit any equipment, but merely will have meeting place for their friends. Their booth is No. 417 and H. R. Malley, Vice-President, A. F. Mackenzie, Chief Engineer, and F. A. Moseley, General Sales Manager will be in attendance.

Scintilla Magneto Co., Inc., Exhibit

The Scintilla Magneto Co., Inc., Sidney, N. Y., will exhibit a full line of Scintilla magnetos for tractor and industrial use, adapted to a wide range of power plants from single cylinder auxiliary units to heavy duty and high speed gas engines more generally used in the heavier equipment. A line of Scintilla ignition accessories will also be included.

The exhibit will be in Space No. 456-D. Those in attendance will include Herman Hanni, Vice President and General Manager, and other Scintilla sales and service representatives. The exhibit will be in charge of D. J. Wilber.

Shaw Excavator & Tools Co. Exhibit

The Shaw Excavator & Tools Co., Worthington, O., will exhibit its Model 50 (4-yd.) scraper. The bucket of this scraper is composed of two sides and bottom. The nose of the bottom is high carbon steel, double edged and reversible. The back plate serves as a rear of the "bucket" and also as the lever when the front end of the "bucket" has been raised to discharge the load. The "bucket" being hung from the top rear corners automatically forces the cutting edge into the ground whenever it is lowered. On each side of the "bucket" is placed a telescopic type hydraulic cylinder which is controlled by one lever at the driver's seat. The pump is operating continuously and the raising or lowering of the "bucket" is accomplished quickly and without stopping or changing gears. In filling this scraper, the operator of the tractor drops the front end of the "bucket" on the ground and moves forward. The cutting edge digs into the regulated depth and from there cuts the earth which is forced into



Shaw Model 50 Scraper

the "bucket." When the "bucket" is loaded the front end is raised so that the bottom is about level and about 8 in. from the ground. At this point the cutting edge comes very near to the stationary plate in front, while the rear plate fully encloses the entire back of the "bucket"; since the bottom extends back of the rear plate when filling. The load is thus enclosed, sides, front and rear, and is ready to be transported full speed to the dump. To dump, the operator causes the cutting edge to be raised so that the bottom stands to about a 70-deg. angle while moving. The contents fall down and are spread evenly by the rear plate passing over.

Shunk to Exhibit Tractor Dump Wagon

The Shunk Manufacturing Co., Bucyrus, O., will exhibit the new Camel tractor dump wagon, Meyer snow plows, traffic markers and road grader blades.

The Camel tractor dump wagon has a capacity of 4 to 5 yd. It has a liberal draw bar capacity which is taken off the heavy auxiliary axle. The Shunk Camel is gear driven. The auxiliary axle which carries the full load of the machine is stated to take all the "drag" off the motor, thereby utilizing the full power of the tractor for propelling the vehicle. Another feature of the Camel is the hydraulic governor, which checks the gravity return movement of the



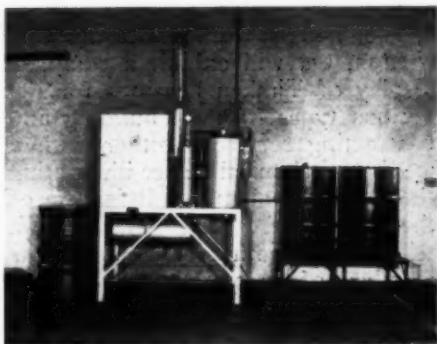
Camel Tractor Dump Wagon

body. Another feature of this machine is that all models are adaptable to an interchangeability of wheel equipment. Crawlers, steel wheels or pneumatic tires may be mounted in the field. Trailers may be hooked behind the units for longer hauls. A new improved direction gear shift will be shown this year for the first time. Right or left hand drives may be had and a choice of International Harvester's two models of the 10-20 tractor, which is its power unit, may be had, either three speeds forward, one reverse or the new directional gear shift of three speeds forward and three speeds reverse.

The exhibit will be in Booth No. 238. G. H. Fegley and C. H. Richardson will be the direct factory representatives in charge.

Skinner Motors, Inc.

Skinner Motors, Inc., Detroit, Mich., will exhibit its senior avia-



Skinner Oil Reclaimer

tion model oil reclaimer; also two other models of oil reclaimers. The exhibit will be in Booth No. 205.

Signal Service Corp. to Show Traffic Devices

The Signal Service Corporation, Elizabeth, N. J., which recently acquired the Traffic Engineering Division of the American Gas Accumulator Co. of Elizabeth, N. J., and the Ray Signs Corporation of New Haven, Conn., will occupy Space No. 138. It will exhibit traffic devices which will include stop and go signals, flashing beacons, reflector signals and signs, non-luminous signs, and miscellaneous traffic equipment.

Solvay Sales Corporation Exhibit

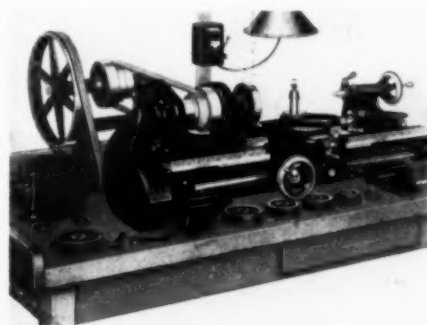
The exhibit of the Solvay Sales Corporation, New York, N. Y., will be pretty much the same as the one used for the past few years. This will include photographic panels featuring the use of Solvay calcium

chloride for dust laying on public roads, concrete curing and the prevention of skidding on icy pavements. The exhibit will be in Booth No. 414 and the following men will make up the Solvay delegation: G. H. Kimber, H. C. Todd, G. P. Spencer, R. H. Sawens, C. M. Adams, Jr., R. A. Scott, F. L. Damon, R. M. Hoyt, G. E. Connell, V. R. Ewing.

South Bend Lathe Works Exhibit

The South Bend Lathe Works, South Bend, Ind. will display four lathes used as servicing equipment in highway building and maintenance work. These lathes will range from the smallest to the larger sizes, including the 8 in. horizontal motor driven lathe; the 9 in. junior silent motor driven lathe; the 16 in. quick change gear silent chain motor driven lathe and the 18 in. quick change gear countershaft driven lathe. The newest product is the 8-in. Junior Lathe which will be shown for the first time at the A. R. B. A. convention. This little lathe is a back geared, screw cutting maintenance unit which will care for many servicing jobs in the highway shop. Among others, it handles such servicing jobs as truck and tractor armature commutator turning; valve refacing; bushing making; piston finishing; flange and axle work and all kinds of turning, facing, boring, drilling, grinding, tapering, finishing, polishing, etc. The principal mechanical features of this 8-in. junior lathe which is stated to use but 1½ ct. per hour electric current are: back geared headstock with six spindle speeds; hollow spindle of alloy steel; set-over tailstock for taper turning; precision leadscrew of ¾ in. diameter for cutting screw threads 4 to 40 per in.; power feed to carriage; simplified controls. All four types of lathes displayed will be shown in actual operation performing maintenance jobs.

The exhibit will be in Booth 413. Representatives at the conference:



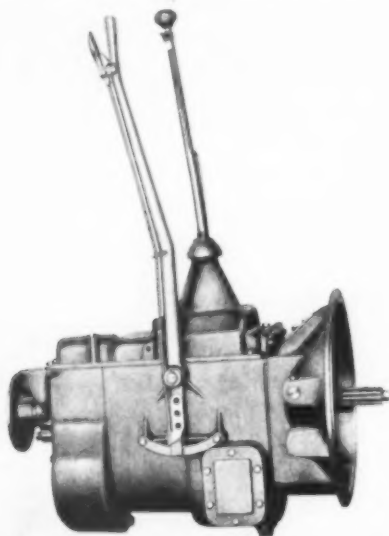
8-In. Junior Lathe

F. C. Erhardt, R. S. Young, F. E. Dorian of South Bend and A. J. Campbell of the Lee Machinery Co., Detroit.

Spicer to Show New Series of Transmissions

Spicer Manufacturing Corporation, Toledo, O., will show a new line of gear boxes adaptable for any truck service. These new models have been designed to permit an inter-changeable flexibility which will enable the truck manufacturer to install either a four, five, eight or twelve speed assembly (excepting only the 320 Series which will not be furnished with twelve speeds).

The basic model of each of these new series will be a four speed as-



Spicer 525 Unit Power Transmission

sembly, to the rear of which an over-drive unit may be attached which will give five speeds forward and one speed in reverse. By replacing this over-drive unit with another over-drive model, eight forward and two reverse speeds may be obtained, and by installing a third over-drive model to the same basic four speed assembly, twelve forward and three reverse speeds are obtained. In addition to the standard low reverse speed obtainable in the basic four speed model, provision can be made to install a high reverse speed by using a different case. This high speed reverse is accomplished by installing an interchangeable case containing the high-speed reverse gears.

Splitdorf Electrical Co. Exhibit

The Splitdorf Electrical Co., Newark, N. J., will exhibit its complete line of magnetos, spark plugs; ignition cable and ignition coils will be

shown. A new magneto, known as the Splitdorf type "C" will be featured in two, four and six cylinder models. The exhibit will be in Booth No. 208 and the following will attend the show: J. Budd Bleiler, General Sales Manager; E. D. Roach, Equipment Sales Manager, Central District, and Lee L. Sable, Sales Representative.

Stover Exhibit

The Stover Manufacturing & Engine Co., Freeport, Ill., will have a booth fitted up with table and furniture and possibly two small engines on exhibition. The main idea, however, will be to just be there with representatives from its sales, engineering, and factory departments in order to answer all questions and dispense general information with reference to its line.

Timken to Have Complete Display of Its Bearings

The Timken Roller Bearing Co., Canton, O., will exhibit a complete display of Timken bearings for the various types of road building and contracting service together with a moving mechanical device illustrating the positively aligned roll feature of the Timken bearing. The exhibit will be in Booth No. 315, and the members of the organization to be in attendance are: L. M. Klinedinst, vice-president; W. B. Moore, sales manager, industrial division; S. M. Weckstein, industrial engineer; H. V. Fleming, Detroit district manager; G. W. Curtis, Milwaukee district manager; J. W. Weir, Cleveland district manager; R. P. Kelley, advertising manager.

Timken-Detroit Axle Co. Exhibit

The Timken-Detroit Axle Co., Detroit, Mich., will occupy Space 244. Its entire staff will be in attendance. The exhibit will consist of axles as follows:

One SWD-1410-W complete with 10-stud Budd hubs and drums; one SBT-75-H complete with 16 by 2½ brakes and 5-stud Budd hubs and drums; one 65200 shell cut in half—mounting on one-half a 65200 carrier and 17¼ by 4 BY brakes—mounting on the other half a 75200 carrier and 17¼ by 4 H brakes. In other words, this is the same as we displayed at the 1931 Road Show; one 58200-H axle with 17¼ by 4-in. brakes—on one end 6-stud Budd hub and drum; one 35100 front axle with 17¼ by 3 H brakes on one end, and 17¼ by 3

TW brakes on the other end; one 84220 trailer axle—one end equipped with BY brakes and Ford 5-stud Budd hub and drum—the other end equipped with hydraulic brakes with a Chevrolet 10-stud Budd hub and drum; one 86720 trailer axle—Westinghouse brakes—one end equipped with hub and drum; one disassembled high traction differential.

Tite-Flex to Show New Product

The Tite-Flex Metal Hose Co., Newark, N. J., will display its all-metal pressure tight gasoline and oil tubing as well as a new product—an all-metal bendable pipe. This pipe is constructed from a heavy metal strip. The edges of the strip are fully interlocked, producing a series of sliding joints which function to make the pipe bendable. These joints in turn are made pressure-tight for exhaust gases with a special metal wire packing. The exhibit will be at Booth No. 408.

Toncan Culvert Mfrs. Assn. Exhibit

The Toncan Culvert Manufacturers' Association, Massillon, O., will exhibit an assortment of culverts made from Toncan Iron. The association exhibit space will be No. 303. In addition to the standard round corrugated sections, the exhibit will also include nestable culverts, flat bottom sections, perforated drains and Tyton sluice gates. Members of the association will be in attendance during the show, in addition to the following officers and representatives from the association headquarters: L. S. Hamaker, President; A. J. Roof, Secretary; C. W. Ruth, Advertising Manager; J. T. Hay, Toncan Iron Metallurgist; F. A. Kelly and Ralph W. Baker.

Trackson Co. Exhibit

Trackson Co., Milwaukee, Wis., will feature three comparatively recent developments in Trackson equipment. These are the Model GH Trackson McCormick-Deering crawler tractor, the Trackson crawler wagons and the Trackson high shovel.

In the crawler tractor simplicity is the keynote—a minimum of moving parts, with each part performing its function in the simplest possible way. Track shoes are cast in one piece, without parts to wear and loosen, and of greater length. Simple hand-wheel steering is another notable feature. The crawlers are

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of rigid frame construction. Extra-heavy truck wheels and bearings are provided to allow a wide safety margin for the great super-imposed loads and strains of auxiliary equipment. The motor unit does not protrude ahead of the crawlers but is centered fore and aft between them. This, together with the wide spacing of the crawlers, effects proper balance for the operation of front, side and rear-end equipment. The track shoes and drive sprockets are readily reversible for extra wear and practically double-life.

The Trackson wagon has a loading height of only 61½ in. without the



Trackson High Shovel

flareboard. It is of all steel construction yet weighs only 10,000 lb. An armored top and cast steel headers at the front and rear make it amply rugged to withstand the whacks and bangs of tough service. The tongue is a rigid tube, and incloses a sturdy spring drawbar which is fully protected from dust and dirt. A single lever dumps and winds up the heavy plate doors which close uniformly tight because of a special cable equalizer. The crawler wheels are extremely simple and rugged. The shoe bushings and pins are easily renewed when worn, also the all-important tension members which maintain camber in the tracks and keep the wheels easy running.

The Trackson high shovel has a bucket of ¾-in. steel plate, reinforced by ½-in. by 6-in. plow steel cutting edge, the bucket seats are extra heavy high carbon steel. The lifting arms are heavy 4-in. H-beams, securely reinforced. The main side frames which absorb the digging and hoisting strains are ¾-in. by 9-in. bar steel.

The exhibit will be in Booth No. 237. Those who will attend are: W. H. Stiemke, Vice-President and General Manager; L. E. Dauer, Sales Manager, and E. H. Schultz, L. E. Andrews and Irvin Kunert, Sales Representatives.

Universal Crusher Co. Exhibit

The Universal Crusher Co., Cedar Rapids, Ia., will show a model crusher in operation and also will display photographs of its varied line of crushers in stationary and portable styles with elevators, conveyors, screens and bins. The exhibit will be in Booth No. 254-A. Those in attendance will be: W. L. Harrison, L. W. Dunlap, F. L. Shramek, R. D. Conway and E. A. Velde.

Vellumoid Co. to Show Packing and Gaskets

The Vellumoid Co., Worcester, Mass., will exhibit Vellumoid sheet packing and Vellumoid gaskets for oil, gasoline, and water joints. Vellumoid packing is a very strong vegetable fibre sheet, chemically treated to make it oil, gasoline, grease, air and water proof, and exceedingly tough. It contains no rubber, or rubber substitutes, and oil cannot attack it.

The exhibit will be in Space 440, and the following representatives will be in attendance: Charles S. Livingstone, Sales Manager; Paul G. Painter, Sales Representative; James Crothers, Detroit Manager.

Union Steel Products Co.

Union Steel Products Co., Albion, Mich., will show bridge and road accessories. Their exhibit will be quite similar to the one at St. Louis last year, illustrated herewith. D. H. Bitney and R. L. Way will be in attendance.



Exhibit of the Union Steel Products Co. Showing Bridge and Road Accessories

Walter Motor Truck Co.

Walter Motor Truck Co., Inc., Long Island City, N. Y., will exhibit Model FBS, 130 hp. 5 to 7 ton snow fighter; also its Model FN 2½ ton, 85 hp. unit. The snow fighter has a four point positive drive, a 10 ton 1 range tractor type transmission and a unique double reduction drive.

The exhibit will be in Space 223. Those in attendance will be L. G.

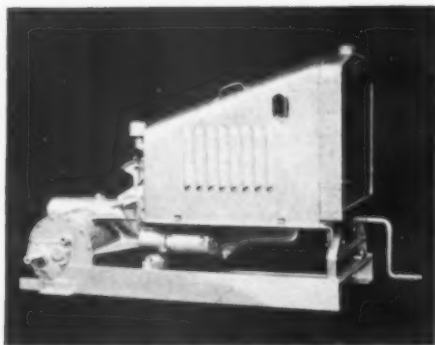


Walter Snow Fighter

Stelzle, President; Maurice Walter, Secretary, and James H. Sharkey, Sales Manager.

Waukesha to Show New Power Units

Waukesha Motor Co., Waukesha, Wis., will exhibit in Space No. 200. The Waukesha 6-cylinder diesel of 180-200 hp. will be shown to the public for the first time. It is a 7¾ x 8½ engine and follows the essential features of the 4-cylinder diesel that was shown at the Road Show a year ago. It is a four cycle, solid injection unit with Bosch injection pump and fuel system, a special compressed



Waukesha Truck Mixer Unit

air starting system, and the Waukesha ell head, high turbulence combustion chamber. In addition to this, two special 6-cylinder engines, popular in the industrial field, will be shown with improvements that add greatly to the performance, both as to output and economy.

There also will be shown a new power unit in the 10-20 hp. range which completes the Waukesha line for the smaller industrial operations. This engine will be exhibited with enclosing house and power take-off. Two sizes are available, both four cylinders, one 3 x 4 in., and the other 3 1/4 x 4 in.

For truck mixing units a special power plant is now available in sizes ranging from 15 hp. to 35 hp., completely mounted as a unit with a right angle reduction and reverse gear and heavy duty clutches. The 14:1 reduction is accomplished by two steps, a double bevel drive which through jaw clutches, serves as a reverse; and straight spur gears.

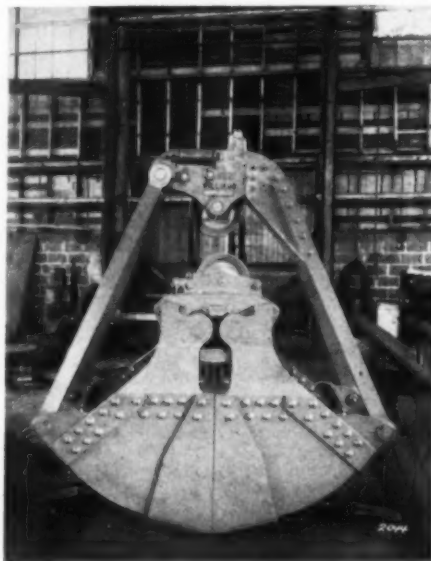
The 4-cylinder diesel which will be located on the floor level so that it can be examined closely is the 75-100 hp. size. The exhibit is being planned and executed by P. C. Ritchie, Advertising Manager, in charge of publicity. The company will be represented by: H. L. Horning, President; J. G. Swain, Sales Manager; J. A. Mahoney, J. M. Boorse, H. V. Kilpatrick, W. M. Jones, F. W. Gargett, L. L. Bower.

Wellman Engineering Co. to Exhibit New Williams Bucket

The Wellman Engineering Co., which acquired recently the Bucket and Trailer Department of the G. H. Williams Co., Erie, Pa., will exhibit the following buckets: 1 Yd. Williams favorite clam shell bucket, 3/4 Yd. Williams new type MF clam shell bucket, 1 Yd. Williams type BF drag line bucket. Also a complete list of enlarged photographs of the heavy duty Williams trailer.

The booth space is No. 147 and

there will be in attendance the following from the Wellman organization: Geo. W. Burrell, President and General Manager; A. E. Gibson, Vice-President and Assistant General Manager; H. P. Glidden, Sales Manager; H. Warriner, Sales Department. In addition there will be the following who were formerly officials of the G. H. Williams Co. at Erie, who are now associated with the Wellman Co. in the bucket and trailer department which that company acquired by purchase and moved the business to its plant at Cleveland: W. C. Swalley, Manager of the Williams Bucket and Trailer Department; A. J. Lichtinger, Assistant Manager Williams Bucket and Trailer Department; Carl F.



3/4-Yd. Williams New Type MF Clam Shell Bucket

Weiblen, Sales Manager, Williams Bucket and Trailer Department.

The 3/4 Yd. Williams New Type MF clam shell bucket will be exhibited for the first time.

Western Metal Specialty Co. to Show Engine Housings

Western Metal Specialty Co., Milwaukee, Wis. will exhibit engine housings, gas tanks, hoods for trucks and other sheet metal products. All these products are designed and manufactured by the company in its factory. The company also will display engine housings which it makes according to the specifications furnished it by its customers, also fuel tanks which it manufactures, these tanks vary in their construction—some of them are soldered; some are welded. There likewise will be on exhibit rear guards, mufflers for industrial motors, cowls, fenders,



Engine Housing of Western Metal Specialty Co.

hoods for automotive trucks and sheet metal products of that type.

Julius J. Goets, the president of the company and Lyman McIntosh, engineer, will be in attendance.

Western Stamping & Mfg. Co. Exhibit

The Western Stamping & Manufacturing Co., Cleveland, O. will exhibit highway signs and markers. The exhibit will be in Building F, Space 202-A. J. B. Martin, Sales Manager and H. M. Bowman will be in attendance.

White Co. to Show to New Refuse Collection Truck

A newly developed motor truck for the collection of garbage and refuse and for snow removal will be a feature of The White Co. exhibit. This new truck, with but a few changes, is typical of the 774 Whites recently ordered by New York City. For this new truck the White Co. has employed a double drop frame chassis, giving the advantage of low loading height. The body, designed by the White Co., is fully enclosed, assuring odorless and dust proof collection. There is a door for loading on each side in the front end of the body. The truck can be utilized for snow removal, the bumper and front end construction being designed particularly for the mounting and operation of plows. The top of the body has hinged covers which



New White Truck for Collection of Garbage and Refuse

can be folded back so that the body can be loaded from the top by means of mechanical snow loaders. This newly developed truck is available in several types of bodies.

Another exhibit of interest will be the White Model 643 SW-410 chassis, a 6-wheel unit developed for heavy construction work. In addition to these two exhibits there will be shown a display truck, displaying for close inspection all the important working parts of a White truck.

Those who will represent The White Co. are George F. Russell, Vice-President and Sales Manager; J. N. Bauman, Sales Promotion Director; H. P. Starbird, in charge of the exhibit; J. R. Logan, C. I. Fraley, R. J. Soulen, J. R. Bryan, R. S. Lapham, R. E. Laisy and A. K. Brumbaugh.

Wiard Plow Co.

The Wiard Plow Co., Batavia, N. Y., will exhibit one each of its No. 64 and No. 69 steel beam plows and one of its 7-tooth grade-rippers or scarifiers. Exhibit will be in Space No. 140 and Robert Male and Henry Wiard, Assistant Superintendent, will be in attendance.

Willett to Show New Equipment

Willett Manufacturing Co., Grand Rapids, Mich., will exhibit its new model spring-scraper for attachment to trucks for maintaining gravel and dirt highways, and a new road and street sweeper which has just recently been placed on the market. A new hydraulic power unit, which includes an oil gear pump and double clutch with universal joint at each end, and a special wing hydraulic hoist for lifting snow plow wings and a special hydraulic hoist to be mounted on the bed of a V— or heavy blade plow for the lifting thereof, also will be exhibited. The new sweeper is an attachment for light-duty trucks of about 1½-ton capacity. The power for operating the sweeper is taken off from the front end of the truck motor, and once the installation is made the entire sweeper can be either disconnected or reattached in 15 minutes time. The steering of the sweeper wheels is controlled by the steering wheel of the truck and is properly synchronized therewith. The sweeper is designed with a parallel motion principle. The controls for the operation are conveniently located to the driver's hand in the cab. While operating the broom the driver can quickly vary the degree of pressure



Willett Road and Street Sweeper

of the sweeper on the road surface. The weight of the water tank is supported by the sweeper wheels. The flow of water to the sprinkler nozzles is controlled by a gear pump which is driven from the main drive shaft of the sweeper and which pumps the water only when the broom is being rotated.

The Willett exhibit will be in Booth No. 125 in charge of Oscar C. Dolberg.

Winslow to Exhibit Scales for Cement Industry

The Winslow Government Standard Scale Works, Inc., Terre Haute, Ind., will have on display scales for the cement industry, which will consist of scales for cement buggies and wheelbarrows, having two sizes; namely, Winslow No. 1 and Junior. The Winslow all steel roller bearing motor truck scale equipped with full capacity compound beam and type registering beam also will be shown.

The exhibit will be in Booth No. 441.

Wire Reinforcement Institute Exhibit

The Wire Reinforcement Institute, Washington, D. C. will have an exhibit for the first time this year under its name and it is exerting every effort to make this exhibit as attractive and comprehensive as possible.

The Institute has a space measuring 35 ft. on the aisle (space No. 102) which constitutes a splendid

location and will give ample space to set forth much interesting and instructive information in regard to the use of wire fabric in concrete pavements. It is proposed to exhibit samples of the material, many interesting and instructive photographs and numerous technical charts, also there will be certain printed matter in the way of booklets and special papers for any of the visitors who may be interested. A feature of the exhibit will be a group of models illustrating different types of reinforcement as placed in concrete pavements. It is expected also to have a working model which can be operated in such a way as to illustrate construction procedure in the installation and actual placing of sheet reinforcement in concrete pavements.

Some very interesting developments have occurred recently with respect to field practices in the installation of fabric reinforcement, one of the latest being a method by which the first strike-off, preliminary to placing the reinforcement, is made by means of a template operated by cables attached to the finishing machine. This has been successfully used in recent months on a number of projects and has proved extremely practical and economical. It is the intention to feature this as one of the latest developments in field construction methods.

Wisconsin Axle Co.

Wisconsin Axle Co., Oshkosh, Wis., will exhibit its double reduction axle. The axle is classified as a double reduction type because the propeller shaft speed or engine speed is reduced to final wheel speed in two stages. All parts of the driving mechanism are housed in a single piece carrier, designed to give rigidity and maintain correct alignment of gears and bearings under extreme operating conditions. Spiral bevel gears from the first reduction, in which the pinion is forged integral with the shaft, and the bevel ring gear is carried on a cross shaft together with the spur pinion of the second reduction. The large second reduction gear is piloted between the differential side cases and is held se-

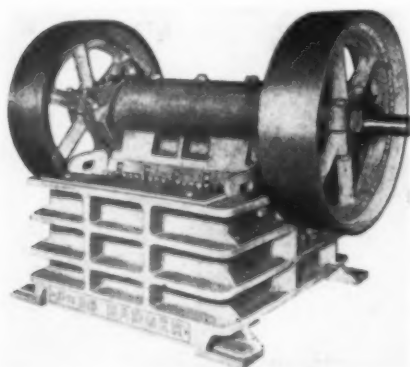


Wisconsin Double Reduction Axle

curely by heat treated nickel steel bolts. Both first and second reduction gears are cut with unusually large tooth form, and in combination with bearings having a high safety factor, are capable of handling long, heavy pulls and to withstand sudden impact loads. All gears, including differential side gears and pinions, are produced from the finest and best adapted alloy steels. Special heat treating processes develop required physical properties—a hard case to minimize wear, and a tough core to withstand shock.

Wisconsin Foundry to Exhibit New Crusher

The Wisconsin Foundry & Machine Co., Madison, Wis. will exhibit its new Badger roller bearing crusher in two sizes 9x36 and 15x38 in. It



Badger 9x36-In. Crusher

also will exhibit a 30x10 in. roll unit for reduction crushing.

The Badger roller bearing crusher is a new jaw type machine. The frame is low, deeply ribbed, and thoroughly reinforced, and machined. The shaft is extra large in diameter and made of high grade alloy steel. It revolves on proportionately large Timken roller bearings and carries the pitman. The movable jaws are bolted to the pitman. The outer roller bearings on the shaft are set in machined boxes which are split and bolted to frame. This makes the bearings accessible for inspection and easy to dismantle. Piston ring seals enclose the bearings. All adjusting mechanism and the toggle plates for controlling the movement of the pitman have machine finished surfaces. The movable wearing surfaces for the toggle plates are also provided with renewable bushings and have Alemite lubrication.

The exhibit will be in Booth No. 441. H. G. Simpkins, Manager Road Machinery Division will be in charge.

Wisconsin Motor Co. Exhibit

The Wisconsin Motor Co., Milwaukee, Wis., will exhibit its model M-3 5x6 6-cylinder industrial engine and an A-3 air-cooled engine. The space is No. 209. H. W. Schnetzky, President; W. J. Johnston, Vice-President; A. F. Milbrath, Chief Engineer, and Harry Cronk will be in attendance.

Wood Hydraulic Hoist and Body Co. Exhibit

The Wood Hydraulic Hoist & Body Co. will exhibit full size operating models of the D6, C12, F4C, W12 hoists; miniature working models of the mechanical hi-lift; and a cased exhibit of the mechanical hoist, also two tables of parts displays. Throughout the convention period the company will maintain open house to out of the city visitors, at its Detroit plants. The exhibit will be in Space No. 307.

Young Radiator Co. to Show Several New Items

The Young Radiator Co., Racine, Wis., has quite a number of new items, included among which are unit heaters for garages, warehouses, factories, large public buildings of all kinds. A new type of heater has been perfected which will stand quite excessive pressures due to the engineering of its top and bottom tanks and to the use of special alloy iron in same, which gives added strength and makes a job which will stand much higher pressures. The company also show one or two pieces of cabinet radiation such as they are building for office buildings, homes and buildings of this type.

The Engine Cooling Division, however, which is the most impor-



Young Cooling Radiator for Large Diesel Engine

tant for this particular show, will have an exhibition a large Diesel engine cooling radiator. In addition to this, the exhibit will show other units of new design for compressor service, for service on the heaviest type of equipment such as shovel and crane units, to the smallest power unit radiators of sheet metal construction.

The exhibit will be located in Booth No. 230 and the company will be represented by F. M. Young, the president; J. J. Hilt, the sales manager, and W. L. Walton, the sales engineer.

Zenith-Detroit Corp. to Show Complete Line

The exhibit of the Zenith-Detroit Corporation, Detroit, Mich., occupying Space 308 will cover a complete line of improved heavy duty carbure-



Zenith Carburetor

reters and filters for gasoline and fuel oil for Diesel engines. The carburetor sizes are from 1 in. to and including 2½ in. in the vertical models; 1¼ in. to and including 2 in. size in the downdraft models. The filters can be supplied for engines up to several thousand horsepower.

Many new features are combined in the carburetor that are of real interest, giving a marked acceleration ability, smoothness of operation, great range, flexibility and general operating characteristics of the passenger car carburetor, yet is of construction to give long life under the most severe operating conditions. The carburetors are fully balanced, which is a safety factor to enable the use of efficient air filters. The best of materials for rugged construction are used with all moving parts enclosed, stainless steel throttle shafts, large bearings that are protected from dirt with felt washers, etc., all being of proven and tried design, making a shock proof and long life carburetor.